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Employment and Employables

I THINK most people will agree that industrialists and business men like to see business operate at a high level. They would be crazy if they did not. The minority of speculators, pawnbrokers, receivers in bankruptcy and others who thrive on the downbeat is so small in comparison to the total as not to count.

By the same token those who own or run a manufacturing plant like to see plenty of people at work in them for high level employment goes hand in hand with high level business. I have never yet heard an employer complain because the demand for his goods forced him to put ten or a thousand more workers on his payroll. His complaint may be that he has not been able to get them.

There is no reason whatever, then, why employers should not welcome a situation in which business could be kept so good that all of the people who could and should work have the opportunity to do so, regardless of color, creed, sex or political affiliation.

There is also no reason why employers, realizing that there are ups and downs in business and probably always will be, should object to the expenditure of government funds in sound public works during bad times to take up the slack in what might be called the legitimate employment volume.

But there is considerable difference of opinion as to what constitutes that volume. Secretary Wallace and the authors of the Full Employment Bill say it is 60 million. Most of our statisticians, economists and even top labor leaders cannot see it as more than 55 million. The Committee for Economic Development figure the labor market in 1947 at 54 million.

One of the great dangers of creating 60 million jobs by law is that if the politicians are wrong and the experts right, people who need jobs and should have them will be saddled, through taxes, with the cost of keeping at work five million persons who do not need jobs and, therefore, should not have them.

Take grandpa, the retired fireman, for example. He was 70 last April and getting along comfortably on his pension. But war wages brought him back into the labor market as a war plant worker. When he is discharged from that work, is he still a legitimate worker?

Or take Mrs. Susan Jones, whose husband is overseas and who took a job to be patriotic and to help out the allotment. When her husband returns and goes back to his old job, must we still make a job for her?

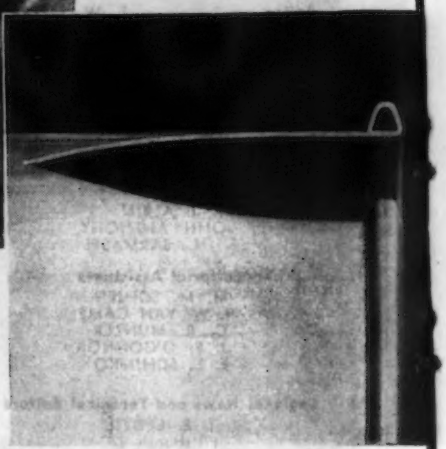
Or take Mrs. Smith, who did not work before the war but stayed home to keep house for her husband, who was a war worker, and to mind the children. That extra money came in handy and her work did, too, during the emergency but is she still to be regarded as a legitimate worker?

Or take Johnny Simkins, who left high school at 16 because war made it possible for a boy to take home a man's wages. Shall we continue to support him in the style to which he has become accustomed or send him back to school?

These questions are indeed serious ones for there are several million of them. And they are particularly serious for the members of the legitimate labor market.

• *On the third draw, the cylinders are formed to 9⅛" diameter by 14½" deep.*

• *Each cylinder is finished with a bead having two 20-degree angles.*



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Here is an achievement in deep drawing—steel cylinders, 9⅛" in diameter by 14½" deep, formed without localized stretching or drawing down of the metal.

The success of this deep drawing job, for which the specifications are unusually severe, results from the skill and ingenuity of the Guyer Metal Products Corporation, Chicago, and the fine and uniform quality of Inland Deep Drawing Cold Rolled Sheets.

The operations start with 20-gage, 24½-in. diameter blanks. Final dimensions are attained on the third draw, the cylinders being straight from top to bottom and with uniform thickness of metal throughout. Then follows another unusual operation. The trimmed edge is turned back to form a bead with two 20 deg. angles.

Thousands of these cylinders have been made of Inland Cold Rolled Sheets, and breakage has been held to the minimum. When you have a deep drawing or severe forming problem, call for an Inland engineer. He will work with you in determining the steel best suited to your product and manufacturing methods.

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The IRON AGE
Sept. 10, 1945

NEWS FRONT

► German developed tool steels, special alloy steels, and heat resistant steel, both prewar and emergency specifications, have been studied by American technicians, and exact analyses have been released for general use.

► Government planners base their predictions of serious unemployment this year and next partially on the fact that it will be virtually impossible for Washington to "prime the pump" through extensive public works.

Construction materials will be in generally short supply, so any diversion to government construction would only decrease private building.

► Occupation costs in the U.S. zone in Germany will probably level off at about $750,000,000 per year and involve some 500,000 men, the former despite all efforts to live off the German economy.

Both figures will likely come under severe criticism in the U.S. within the next year, but authorities are of the opinion that the value of a U.S. voice in that section of Europe would be well worth the cost.

Germany is probably finished as a functioning economy as the four occupation zones effectively throttle the flow of communication and goods, and any significant alteration of this compartmentation in the next few years is unlikely.

It is conceivable that American business interests may eventually come to own and operate various German industrial concerns in the U.S. zone.

► In England various articles removed from price controls have doubled and tripled in price.

► A 40-passenger jet-propelled airliner is being considered by A. V. Roe, Ltd., British builders of the Lancaster bomber. It probably will be combination jet and propeller units operating from common gas turbines.

► Flash-butt welding of copper alloys is entirely practicable provided properly designed equipment is available and adequate care is taken in making mechanical and electrical adjustments.

The most important factor regarding mechanical details of the machine is the design of the moving slide. There should be neither side play nor lift between the slide faces, but at the same time it is important to insure a minimum of frictional resistance between them.

► Utilization of mechanical cams in conjunction with a flame-planer permits trim edging of plate edges to any desired contour and combination of bevels within limits of ±0.003 in. High quality welds result, and twice the production rate is obtained than by use of hand-operated cutting equipment.

► Despite the announcement that priority ratings, except for AAA, MM and CC orders, will be abandoned Sept. 30, manufacturers are still appealing to WPB for ratings. It would seem that some business is fearful of throwing aside its crutches and taking its first step alone.

► Germany is only now beginning to show signs of partial recovery from the most complete economic paralysis in modern history. Coal production has risen in the past four months from 4 pct of its 1944 average to 20 pct. Local manufacture has increased to 25 pct of 1944 and food production in the American zone can now supply 50 to 55 pct of the German population at the rate of 1200 calories a day.

► A 1.25 lb per hp automobile engine, developed by West Coast's Taylor Engines, Inc., will be used under license by Crosley Motors, Inc. This 26 hp engine, fabricated by a copper-hydrogen brazing process, is built of plate steel and tubing and extensively utilizes stampings.

► The Surplus Property Board regulation covering plant disposal gives no preference to companies presently operating government facilities. RFC is specifically authorized to grant liberal terms to local groups in a deliberate effort to avoid "concentration of economic power".

Plants are to be sold at "fair value", to be determined by what an average buyer would pay to obtain the plant for profit purposes. "Fair value" may be ignored to further the "social objectives of the regulation".

Diecasting Die Design

... Good diecasting design is based on satisfying functional requirements as well as being designed within the scope of adequate and economical fabricating method. The data presented herewith deal primarily with the subject from the point of view of the economics of die design. Observance of the general rules governing good diecasting practice will prevent use of features in a casting which lead to difficulty in die fabrication or casting production and will result in the most economical and efficient output.

By H. L. HARVILL
Harvill Mfg. Co., Los Angeles
and
PAUL R. JORDAN
Consultant, Los Angeles

THE first element of diecasting die design that must be considered is the manner in which the two die halves will be parted. While it may seem elementary, the basis for establishing the parting line of any diecasting is to so part the die that the removal of the solidified casting will be possible and accomplished in the easiest possible manner. The most desirable condition is a straight parting line. In the first place, this simplifies the construction of the dies, and secondly it reduces the amount of cleanup work required on the casting in order to remove the flash which is invariably formed to some extent at the point where the dies are parted. In low-pressure diecasting this may not be a serious consideration. In high-pressure diecasting, flash can only be prevented by a very efficient locking means, and under the best available conditions there may be a small amount of give between the die faces, forming a minimum of flash.

Improper parting of a diecasting frequently results in high cost of both die and casting, due to the increase in die work necessary and the unnecessary requirements for hand filing. Whenever possible, the casting should be designed so that the parting line may be established on a single plane parallel to the surface of greatest length of the casting so that a minimum amount of die sinking is done. The shallower the cavity in the die blocks can be, the more satisfactory will be its operation since the casting is then ejected over the shortest possible distance. Simple changes in design of the part which do not affect the utility value of the casting may be frequently made with the object of positioning the parting line at the best possible point in the casting.

In fig. 1 is illustrated three possible methods of establishing a parting line for a box-type casting. The top view represents the most desirable condition, provided the depth of the box will permit parting on the flange. By establishing the parting line in this position, die construction is simplified; however, sufficient draft must be provided to allow for free ejection of the casting upon solidification. By parting the casting in the manner shown in the center illustration, the die work is made more complex and considerable difficulty in production would probably be encountered. Parting the die in the fashion shown in the bottom view would require a joggled parting line in order to eject the casting from the die.

The parting line should not be established at a sharp corner of the casting, but rather slightly below the flat surface so that the corner can be radiused for ease in die trimming, unless the part can be produced in a cavity in one die half.

Provided an alloy possessing a high degree of ductility is specified, it is often quite possible to bend castings to a shape which would be difficult to cast and which would require an irregular parting line. In fig. 2 the casting is fabricated flat with the holes cored and is then bent to shape. If the casting were cast to the finished shape shown, it would be impossible to core the holes and an irregular parting line would be required.

While it may seem paradoxical, parting lines may be sometimes changed from a single to an irregular or joggled plane to facilitate the production of the part, particularly in those cases where the use of a movable core may be avoided by employing an irregular parting line. Typical cases are fig. 3, in which examples the use of a joggled parting line overcomes the necessity for movable cores.

Core Normal to Parting Plane

Frequently the use of movable cores is unavoidable. Fig. 4 illustrates the die and the casting which it produces wherein a single movable core is operated in one direction normal to the parting plane of the die. Included in the cavity are two stationary cores for forming the holes in the part. The movable core is shown attached to its mounting bracket and partially removed. It is fully closed when the metal is injected into the die. When the metal has solidified around the core and the dies are opened, the bracket is moved, drawing the core from the casting and leaving a hole cored in the casting. As the machine is closed following the removal of the cast part and preparatory to again injecting metal into the die cavity, the core is moved forward to its closed position.

Cores need not be limited to an angle normal to the parting plane of

the dies but may be pulled at various angles as shown in fig. 5. In this instance a part is formed which is fairly complex in shape with two cored holes, one of which is at a right angle to the axis of the part while the second is at a 45° angle with relation to the axis of the part.

The possibilities of intricate coring in diecasting are well illustrated by the die and the part which it forms as shown in fig. 6. This casting has a total of eight cored holes, three of which are formed by stationary core pins in the ejector die half, while five additional holes are cored by movable cores, three of which are at an angle to the axis of the casting. It will be noted that the hole which runs longitudinally through the casting is cored from two directions, with the cores meeting in the center of the casting. This is common practice in those cases where long holes are encountered or where the taper on the core pins must be held to a minimum. The use of split cores has the disadvantage of forming a thin sheet of metal between the ends of the cores, since it is virtually impossible to tighten the cores to the extent that metal will not flow between them. If the hole is to be machined, this flash does not constitute a serious disadvantage.

It should be noted that two core pins are carried by the core retracting mechanism in order to form two parallel holes. Stock from the die blocks has been removed on three corners so that the core pulling mechanism may be mounted on these surfaces. The use of a reinforcing web at the juncture of the body of the casting and the integral Y-ports should be noted, since it is good diecasting design practice.

Use of Slides

The casting which is produced by the dies shown in fig. 7 can only be made by the use of sliding members of the die. In such cases as this, the die cavity may be almost entirely formed in these movable slides which are a part of the ejector half of the die and are withdrawn from the casting before the casting can be ejected. Because of the raised irregular sections on its surface, it would be impossible to produce this particular drum by any method of conventional cavity formation. These slides operate in much the same manner as a core, in that they are moved into the die blocks prior to each injection of metal and withdrawn from the die blocks prior to the ejection of the casting. This type of die construction may take a wide range of formation

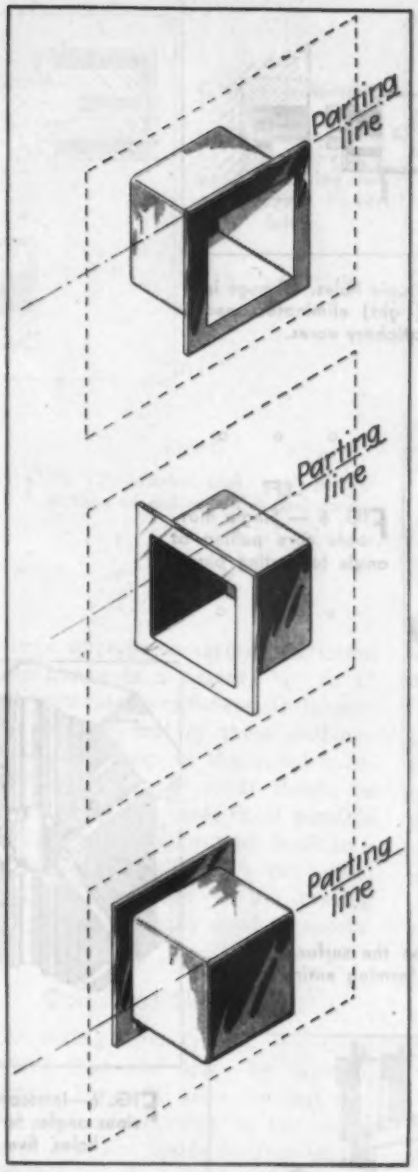
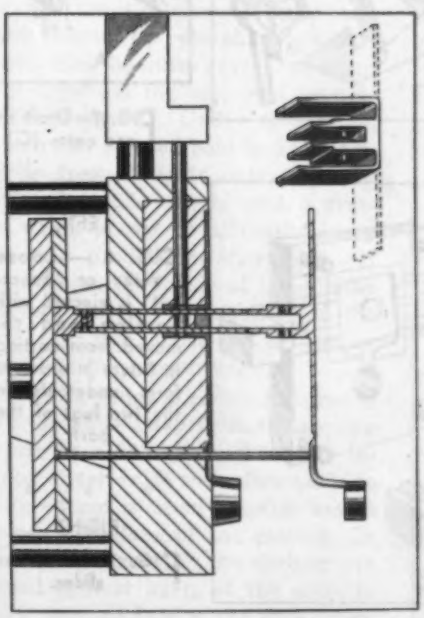


FIG. 1—Possible methods of parting box-type casting. Top method with parting line on flange is preferable.

FIG. 2—Castings may be cored flat and bent to shape.



extending from a simple slide which actually may be difficult to distinguish from a core on through the various stages of complexity to the examples shown.

Construction of a die which extensively utilizes slides in its operation is difficult and time-consuming. The problems of machining the inside surfaces of the slides are much greater than the problems encountered in the ordinary types of die sinking. Extreme accuracy must be employed in fitting the slides to the remainder of the die as well as in matching the impressions. These types of dies are the most costly of all diecasting dies, but their use generally indicates a part which would be extremely difficult to fabricate by any process other than diecasting and when considered over the normal life of the die, the initial tooling charge is by no means prohibitive.

The requirements of design often dictate a particular part be so formed as to include undercuts or recesses that would normally preclude the possibility of diecasting the part because of difficulty encountered in ejecting the casting from the die. In order to circumvent this condition, loose pieces are frequently used. These pieces are ejected from the die cavity with the casting, and after being removed from the casting, are repositioned in the die preparatory to the formation of another part. Such a situation is illustrated in fig. 8, which shows both halves of the die, the casting formed by the die, the loose piece which is ejected at the time the casting is made and a fixture employed for the removal of the loose piece from the casting.

This practice of using loose pieces greatly retards the production cycle, since the loose piece must be removed from each individual casting and replaced in the die cavity by hand. Generally, the production rate of a part requiring the use of a loose piece is reduced by 50 pct below the production rate for the same casting if a loose piece were not required. On the other hand, ultimate production economies often result because it is possible to form parts of greater design intricacy and overcome the necessity of treating a part as an assembly.

Draft Angles

Probably the most important single factor in the design of diecastings is allowance for adequate draft angles for removal of the solidified casting from the die. Generally speaking, a minimum of ½° draft is required on all outside surfaces of a diecasting which are at right angles to the part-

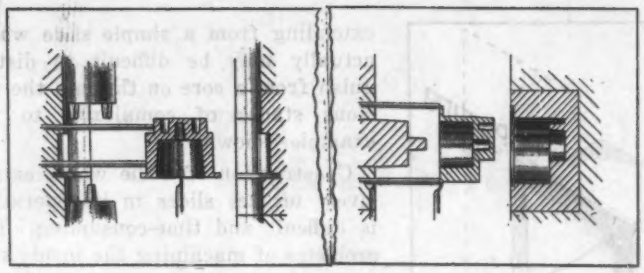
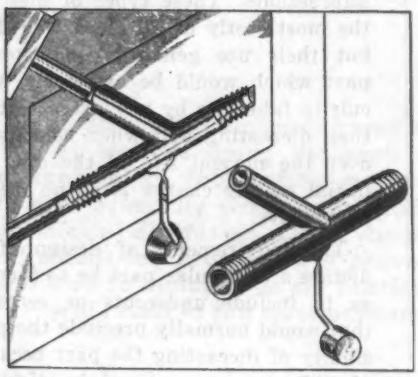


FIG. 3—Parting at left requires slide to core holes. Change in parting line to facilitate production (right) eliminates need for slide by coring holes with stationary cores.

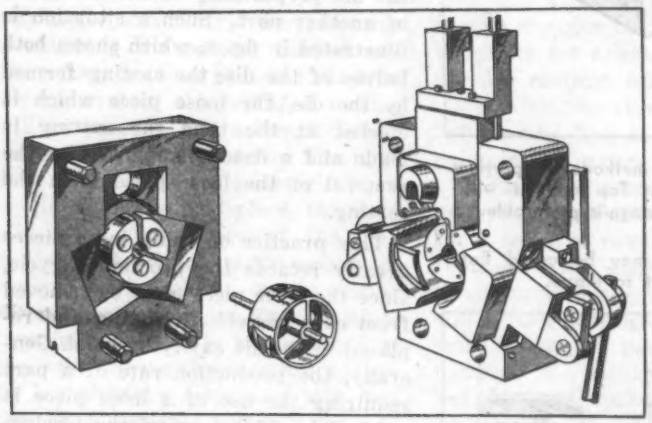


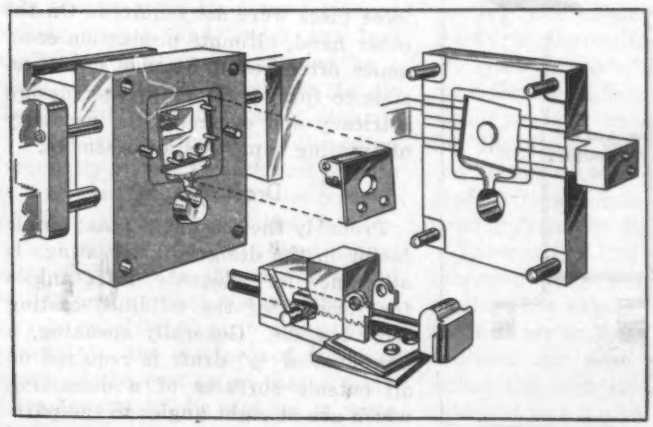
LEFT

FIG. 5 — Single movable core pulling at angle to parting plane.

BELOW

FIG. 7—Drum casting with raised sections on the surface could only be produced by movable slides forming entire outside surface.





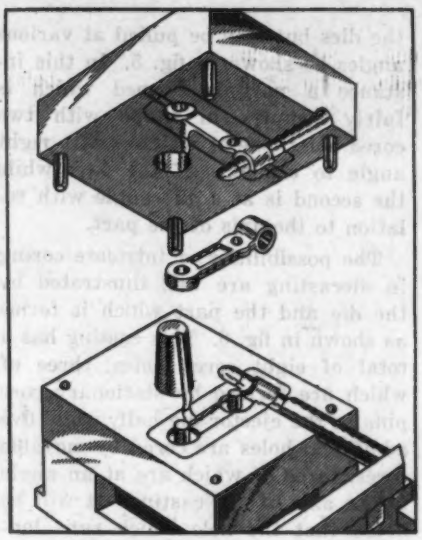


FIG. 4—Die and casting it produces wherein single movable core is used.

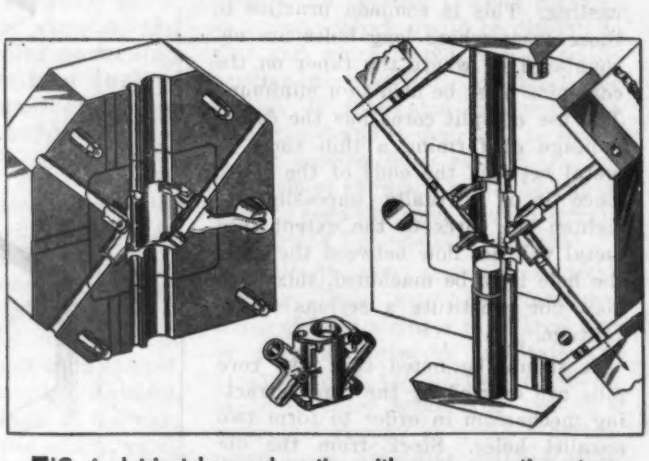


FIG. 6—Intricately cored casting with cores operating at various angles to parting plane of casting. Total of eight cored holes, five of which are formed by movable cores.

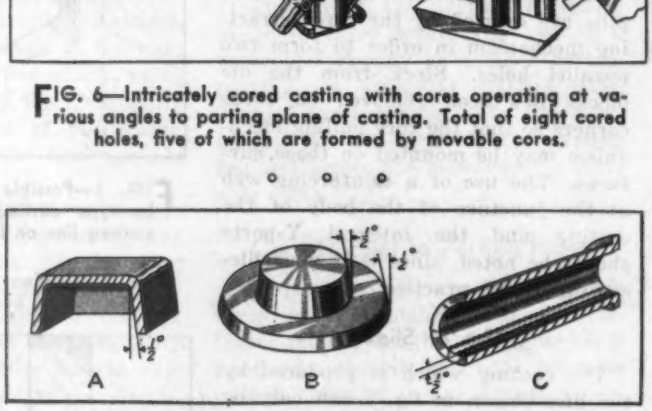


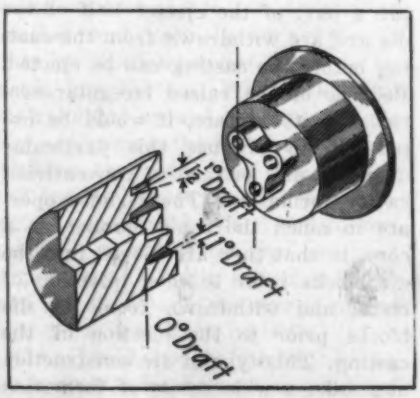
FIG. 9—Draft on inside surfaces (A), outside surfaces (B), and cores (C) to allow for casting ejection without galling of surfaces.

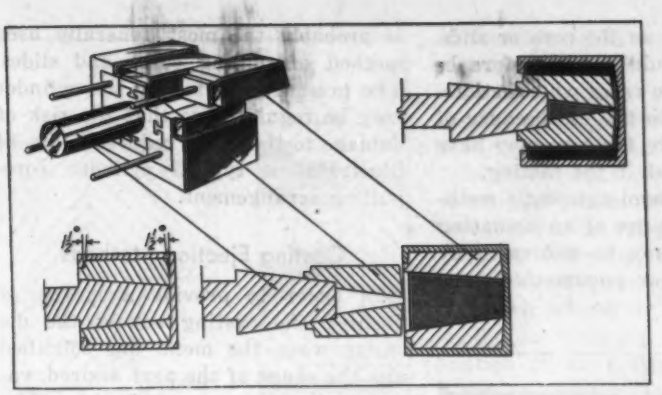
LEFT

FIG. 8 — Loose piece or "knockout" is ejected with casting and removed from casting in fixture in order to form undercuts in the two lugs of the part.

RIGHT

FIG. 10—Draft on slides.





LEFT

FIG. 11—Removal of interlocking loose pieces. Surfaces moving against casting require draft (lower left).

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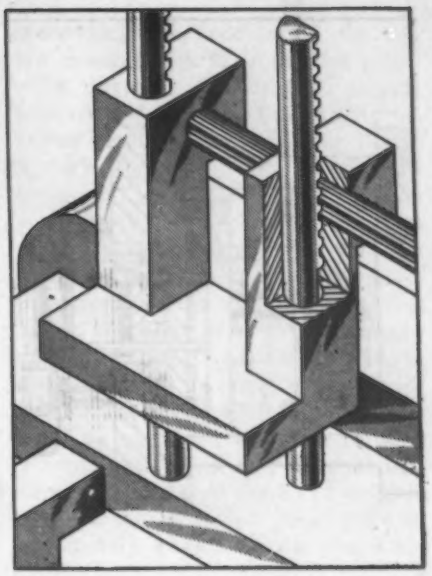

RIGHT

FIG. 12—Manual rack-and-pinion method of pulling slides and cores.

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ing plane. In those cases where shrinkage of the castings is restricted, such as the box shown in fig. 9, ½° to 1° draft should be allowed to provide for rapid ejection of the casting without galling or scoring. In those cases where unrestricted shrinkage is provided, relieving the outside surfaces of the casting, ½° of draft per side will generally suffice. For highest possible production from a die, the maximum allowable draft should be provided where heavy taper will not interfere with the function of the casting. As much as ½° to 1° for short dimensions and as much as 2½° for long dimensions is suggested (fig 9). In those instances wherein the design of a diecasting is predicated on the high order of surface finish obtainable in a diecasting, a maximum amount of draft should be allowed.

The draft required for inside surfaces of diecasting is largely controlled by the size of the casting and the extent to which the shrinkage of the metal is restricted by a part of the die. In small and medium-sized castings wherein no severe restriction of shrinkage is a factor, ½° to 1° draft is normally sufficient. In larger-sized castings and in those castings wherein shrinkage of the metal is severely restricted, 2° draft should be allowed. In some cases it is possible to reduce these amounts of draft to a minimum, generally ½° per side; however, the design of the casting must be exceptionally good to accomplish this.

Cores and Slide Draft

Extracting cores from a diecasting requires that the cores be tapered, otherwise they will seize the cast material and either stick in the cored hole or tear the inside surface of the cored hole as the core is withdrawn. The poorer the bearing qualities of the material, the more critical this factor becomes. Provisions must, therefore, be made in cored holes for an absolute minimum of 1° draft per side and, in the case of hubs and bosses where the shrinkage characteristic may be quite severe, as much as 5° taper on the core pins may be required (fig. 9). Under no circumstances can a cored hole in a diecasting be free of draft unless a very costly collapsible core is used, a practice which is not at all satisfactory from the production standpoint. If the taper on the inside of cored holes interferes with the function of the part, the hole must be drilled or reamed to the proper size.

Draft on slides is rarely required if the slide pulls away from the casting surface at a 90° angle. The only instance where draft on a slide needs to be considered is when the slide moves against a surface of the casting. In fig. 10, two faces of the casting are formed against parts of the slide, in which case one face of the slide which is pulled parallel to a face of the casting must include a draft angle.

The manner in which a loose piece is to be removed from the casting determines the question of draft on those surfaces formed by the loose piece. In fig. 11 loose pieces are utilized to form the undercut interior mounting pads of a diecast box. The center piece is a tapered core with machined keyways to hold the seven surrounding loose pieces in place. As this core is withdrawn, the four loose pieces attached by means of the keyways drop down to a sufficient extent to be removed with the core. The casting is then ejected from the die and the remaining loose pieces forming the inside corners are removed by hand by means of the pins attached to them. The main core does not require draft since it is moving directly away from the bottom of the box;

FIG. 13—Automatic mechanical cam (right top) actuates slide each time dies are opened and closed.

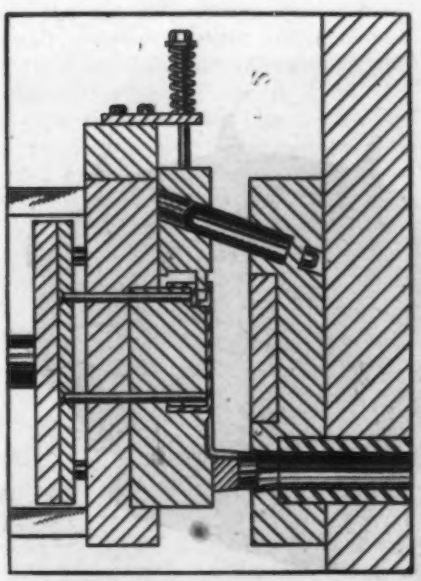
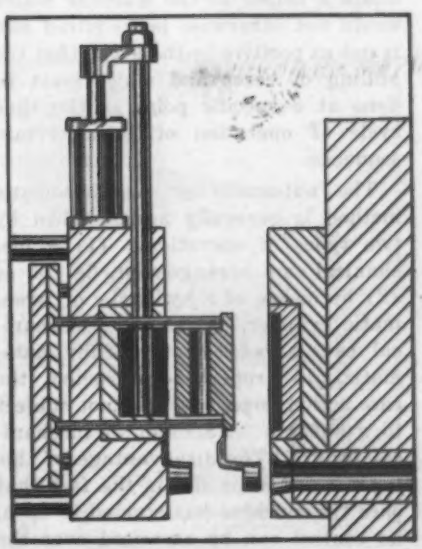


FIG. 14—Hydraulic cylinder (left top) for core or slide operation.



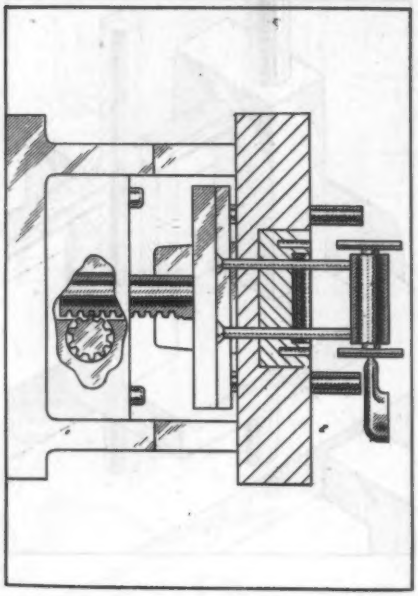


FIG. 15 — Manual rack-and-pinion method of casting ejection.

however, the remaining loose pieces do require draft since their removal requires that they be moved against a cast surface. Draft on the inside edges of the casting is therefore required at the points shown in fig. 11.

Core Pulling Methods

The methods employed to actuate cores and slides fall into two categories—manual and automatic. Fig. 12 shows the conventional type of rack and pinion assembly used to manually operate cores and slides. Manual operation has the advantage of giving the diecasting machine operator or helper a "feel" of the action of the core or slide. In the event that the core or slide becomes stuck in the casting, damage to the die by further pressure on the rack and pinion may be avoided. On the other hand, the method is slow, may necessitate a helper at the machine which would not otherwise be required and is not as positive in the event that the pulling of cores and slides must be done at a specific point in the time cycle of operation or in a certain sequence.

The automatic or semi-automatic method is generally accomplished by two types of operations: (1) a mechanical cam arrangement, fig. 13, or (2) by means of a hydraulic or pneumatic cylinder, fig. 14. The mechanical cam arrangement is fully automatic. If properly constructed, the cam action is positive and not subject to a substantial amount of mechanical failure. The disadvantage of this type of actuation lies in the fact that once the machine has started to open, no control can be exercised over the pressure exerted on the core or slide. The method should not therefore be employed in those cases wherein damage may result to the die because of this fact or where the core may have a tendency to stick in the casting.

Automatic or semi-automatic methods involving the use of an actuating cylinder which may be motivated by either hydraulic or pneumatic means is probably the most generally used method of pulling cores and slides. The pressure exerted by the cylinder may be regulated so that the risk of damage to the die is reduced. Fig. 14 illustrates a typical cylinder core-pulling arrangement.

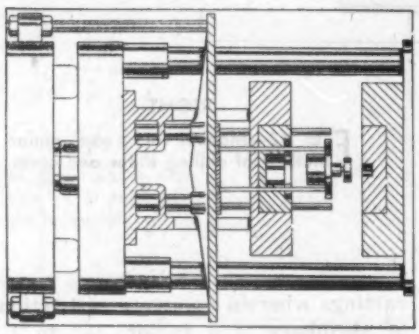


FIG. 16—Mechanical method of casting ejection. Pressure plate overhanging tie bars operates ejector plate when forced forward by rods on either side of tie bars.

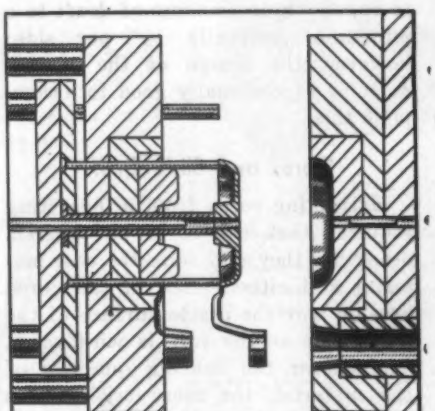


FIG. 17—Sleeve ejector around core (center) in combination with normal ejector pins prevents casting warpage.

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FIG. 18 — Casting above has outboard ejectors around periphery against which ejector pins operated in order to preserve casting surface against ejector pin marks.

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Casting Ejection Methods

In order to provide a means of pushing the casting out of the die cavity when the metal has solidified into the shape of the part desired, various means are employed. The method most generally used is the simple type of ejector pins which operate within the die cavity. These pins are of various sizes depending upon the size and weight of the casting and the area of the surface against which they will operate. The pins are manually operated by a rack and pinion assembly, as shown in fig. 15, or may be operated automatically by either an actuating cylinder or by a mechanical method, as illustrated in fig. 16. For short runs wherein the setup time involved in arranging an automatic method would be a substantial factor of cost, the manual method is generally employed.

Castings produced in semi-automatic or automatic machines must include an automatic means of ejecting the casting. The nature of the method used will largely depend upon the nature and size of the casting. A great deal of ingenuity may be shown by the diecasting producer in designing the ejecting mechanism so as to reduce the cost of the part by accelerating the casting cycle to its highest possible point.

In order to overcome the creation of distortion in a casting section through which a hole has been cored, sleeve ejection is often used. In such cases a sleeve is placed around the

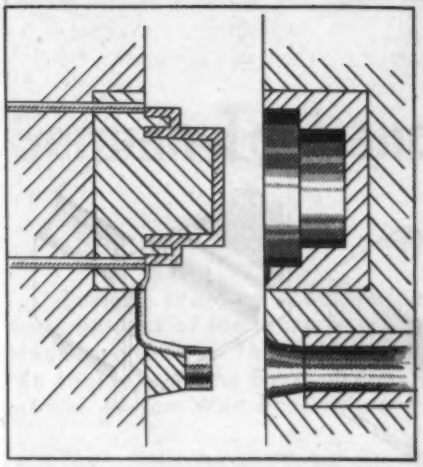

FIG. 19—External undercuts formed by stationary cores.

core, extends through the die block from the ejector plate to the die cavity and is flush with the surface of the cavity, as shown in fig. 17. As the ejector plate moved forward, the sleeve operates against the metal surface at the base of the core pin, pushing the casting evenly off of the pin. Sleeve ejectors may be actuated by any of the three methods used for pin ejection of a diecasting.

Sleeve ejection is rarely the only method of ejection used. Normally sleeve and pin ejection are combined, as in fig. 17, or the pins against the surface may be replaced with outboard ejectors. There occasionally occur certain designs wherein the use of ejector pins against the surface of the casting is impractical, in which case "outboard pins" are employed (fig. 18). This method is particularly advantageous in those cases wherein a high degree of surface finish must be maintained and the "witness" marks of the cavity type ejector pins would be objectionable. To provide for the use of outboard ejector pins, small overflow pockets are machined at the required intervals around the outside surface of the die and the ejector pins are faced into these cavities. As the ejector pins move forward pressure is uniformly applied to the outboard metal protrusions, thus ejecting the casting from the cavity. As in the case of the cavity pins, this method may be operated manually or by mechanical or actuating cylinder methods.

Recesses and Undercuts

While one of the axioms of the diecasting industry is to avoid undercuts at all costs, occasions do arise wherein forming an undercut or recess is entirely feasible and practical. In the case of undercuts and recesses on outside surfaces, it is generally possible to develop some method of parting the die to allow for the formation of an undercut or recess by a stationary core in the die. This is true only when the undercut or recess is at right angles to the parting plane of the cavity. Otherwise movable cores or slides may be employed. Fig. 19 indicates a typical example of an undercut formed by a stationary core in the die while fig. 20 shows the formation of an undercut by use of a slide.

Undercuts and recesses formed on inside surfaces present a much more

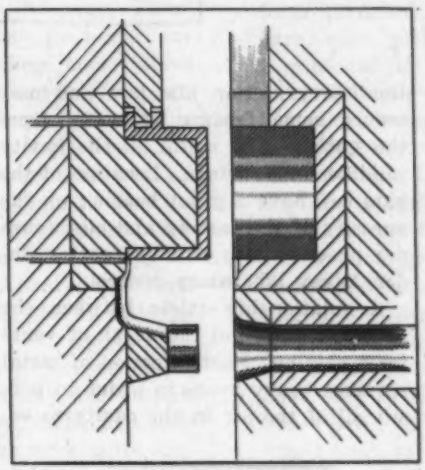

FIG. 20—External undercut formed by slide.

difficult problem and can only be formed through the use of loose die pieces. Fig. 21 shows a typical box-type casting in which an inside mounting boss is formed by means of loose die pieces.

All methods of overcoming the inside undercut should first be explored before deciding that an undercut is necessary. Three possible methods of overcoming the undercut in the box are shown in fig. 22. The first possibility involves the use of outside bosses while the second possibility involves running the mounting bosses to the bottom of the box. The first alternative presumes that outside mounting will not be a detriment to design or interfere with the function of the casting. The second alternative presumes that the assembly contained within the box will clear the extended mounting bosses. It is also possible in some castings to cast an extended boss on the inside surface which may later be machined off, thus forming an undercut. The cost of undercutting by this method should be weighed against the increased piece price of the casting when loose die pieces are used.

Gating and Venting

Gating and venting practice is fairly well standardized throughout the diecasting industry and is largely a case of trial and error for each particular die and the casting it is to produce. These two elements of the diecasting technique are of a critical nature and have a substantial bearing on the production and quality of parts obtained from diecasting dies.

Venting refers to the practice of providing thin slots on the face of the die blocks leading from the cavity to the outside edge of the die blocks through which the air may escape as the molten metal enters the cavity. Strictly speaking, the gate is that portion of the orifice leading to the die cavity located at the exact point the orifice joins the cavity. The portion leading from the metal injection cylinder to the gate is known as the runner.

Gating is most critical for aluminum and magnesium parts and substantially less important in the pro-

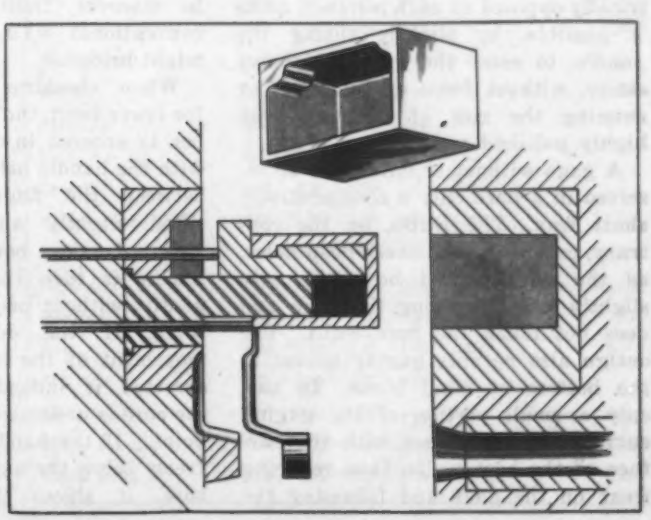

FIG. 21—Inside undercut formed with loose die pieces or "knockout."

duction of zinc diecastings. Gates for zinc diecastings are normally 0.005 in. to 0.250 in. in thickness, varying in relation to the size of the casting and the sectional characteristics of the casting. Gates for aluminum and magnesium castings are normally 0.005 in. to 0.094 in. in thickness, their size being largely controlled by the size and shape of the casting together with the strength requirement of the casting. In the case of thin gates the metal is injected rapidly in order to prevent metal freezing and plugging the gate. In so doing the risk of atomizing the molten metal into the die cavity and thereby inducing excessive porosity and oxidation is encountered. As the gate increases in size, the rate of injection should decrease in speed. Obviously then the casting produced through a thin gate will have a higher rate of production than a casting produced by a heavy gate. Conversely, the heavier the gate, the slower the shot and the higher the density and mechanical properties. In other words, specifying excess strength requirements imposes a limitation on the producer of the diecasting and thereby increases the cost of the part.

Normally the gate leads into the heaviest section of the casting so that the heavy section fills last and may secure some feeding of metal from the gate as the metal in the cavity solidifies and shrinks. Location of the gate can have a great bearing on the porosity of the casting and best foundry practice is to establish gating under X ray laboratory control.

A relationship exists between the size of a gate and the depth of vents for a casting. Fast injection of metal requires heavy vents in order to permit all of the air in the cavity to escape before it is trapped by the molten metal. Heavy venting, on the other hand, may permit flash to form in the vents, creating an increasingly difficult cleaning problem. The vents must therefore be only large enough to permit air to escape while remaining small enough to prevent the formation of flash. As the speed of injection decreases, the size of the vents may be decreased because the metal is not being injected at such high velocity.

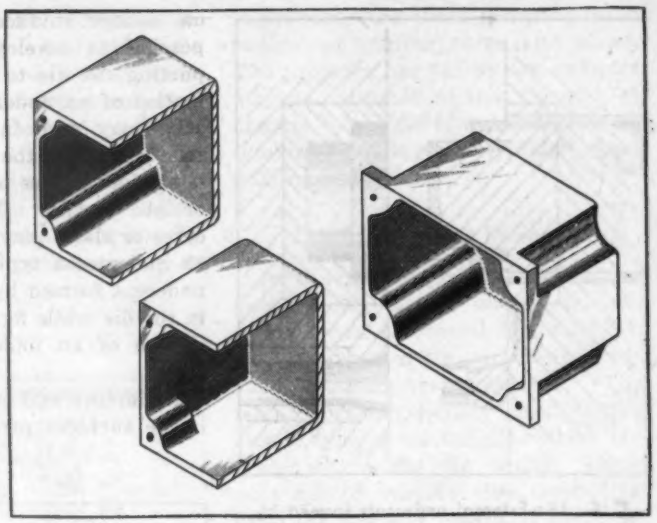

FIG. 22—Overcoming undercuts: By (right) changing mounting to outside pads (upper left), running inside pads to bottom of box, and (lower left) machining undercut from extended pads.

Improved Plug Gage Offers Many Advantages

OFFERED by the Standard Gage Co., Inc., Poughkeepsie, N.Y., the DuBo plug gage introduces an entirely new system of gaging which, it is claimed, reveals more about the condition of a bore than any other type of plug gage. The gage head is a relatively thin disk which is a section of a sphere, and the gaging surface makes contact with the bore walls only at the instant and point of gaging. Two chamfered sections, diametrically opposed on each member, make it possible, by slightly tilting the handle, to enter the gage into bores easily, without force or fumbling, or running the risk of marring even highly polished work pieces.

A gage without chamfer can be inserted in a bore only a comparatively short way. The DuBo, on the contrary, can be used to check deep holes, as the handle need be tilted only slightly when applying the gage and does not touch the bore walls. The design also permits gaging almost to the bottom of blind bores. In use, only a small portion of the gaging surface makes contact with the surface of the bore walls, thus reducing wear on the gage and focussing the gaging contact to a very small area. As the gage may be introduced into bores smaller than its diameter, it provides a means for checking out of roundness or taper, even when these conditions are on the minimum side of the tolerance or smaller than the go dimension. It is consequently possible to check a back taper in a part which the ordinary fixed limit gage could not enter, and to discover faults which conventional plug gages might bridge.

When checking a bore for lower limit, the go member is entered in the bore with the handle held lightly between the fingers and tilted slightly above the axis of the bore. The handle is then lowered gently, without pressure or force. If the downward movement of the handle is arrested it indicates that the bore is undersize at that point. If the handle drops freely below the axis of the bore, it shows that the bore is larger than the lower limit. The same method is used in checking for the upper limit, using the not-go member. The arresting or dropping of the handle clearly indicates whether the bore is within or exceeds the gage dimension.

DUBO gage used for checking the highly finished bore of a bronze bushing.

German Tool and Special Steels

By JAMES P. GILL
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Vanadium-Alloys Steel Co., Latrobe, Pa.

. . . German tool and special steels are described, and analyses of the more popular prewar and war steels are shown. This article is presented through the courtesy of the Enemy Technical Control Committee of the War Production Board.

FIVE companies marketed practically all of the tool and special steels that were used in Germany. Three of these companies were strictly German, one Czechoslovakian and the fifth having their home offices and one plant in Austria with another plant in Germany. The three German companies were the Deutsch Edelstahle at Krefeld, Krupp located at Essen, and Rochlingstahl Steel Works at Wetzler. The Austrian company was the Bohler Werkzeng Stahle with their main plant at Kopfenberg, Austria, and with another plant at Dusseldorf, Germany. The fifth company was the Poldi Hutte, having its main plant at Kladno, Czechoslovakia. Apparently Bohler enjoyed the largest sale of special steels, closely followed by Deutsch Edelstahle.

The five companies maintained branch warehouses in all of the large industrial areas in Germany, the number of these warehouses being between about eight to twelve for each company. The warehouse stocks were quite complete as to sizes and grades and the aggregate amount of such steels in warehouse stocks is of large proportion. Contrary to the American custom the mills did not carry large stocks at the places of manufacture unless the location was in a highly industrial area such as Krupp at Essen.

A striking similarity apparently existed in the methods of manufacture between all of the tool and special steel companies. This statement is based on the study of the methods of manufacture of Edelstahle and Rochlingstahl. All of the companies manufactured their product in the form of rolled and forged bars, cold drawn and ground bars, wire, plate and sheet. Practically all of the steel was melted in electric furnaces, yet each of the companies had some openhearth capacity in which carbon and low alloyed steels might be manufactured. Rochlingstahl was equipped with one 30-ton openhearth furnace using coke oven gas and three electrical furnaces—one of 20-ton capacity manufactured by Demag, the second of 10-ton capacity, and the third of 6-ton capacity. The two latter furnaces were manufactured by Brown Boveri. Edelstahle had nine electric arc furnaces between about 6-ton and 30-ton capacity, two induction furnaces of some four or five-ton capacity, and three basic open hearths of 35-ton capacity. The melting practice was quite similar to that used in America, highly alloyed steels such as high speed steel being dead melted while carbon and special steels such as that of the ball bearing type boiled by the addition of approximately 1000 lb of ore to a 10-ton charge. Slags were made by mixing fluorspar, carbon and lime, and usually two slags were used, although three slags have been tried for some steels. Usually aluminum was

Steels of the Poldi Hutte Works

Steels Manufactured in 1942

High Speed Steel

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
MK Special	0.65	0.20	0.25	4.20	17.5	—	0.70	1.60	15.5
Poldi MK	0.65	0.20	0.25	4.20	17.5	—	0.70	1.60	9.50
Poldi MKH	0.78	0.20	0.25	4.20	17.5	—	0.70	1.60	9.50
Maximum Special 55	0.70	0.20	0.25	4.20	17.5	—	0.60	1.40	4.75
Maximum Special 55G = Radeco D	0.85	0.20	0.25	0.25	12.5	—	0.60	1.85	4.75
Maximum Special 30	0.70	0.20	0.25	0.25	17.5	—	0.60	1.40	2.50
Radeco K	1.35	0.20	0.25	1.05	17.5	—	—	1.35	5.25
Radeco = Radeco 2	1.30	0.20	0.25	5.00	10.75	—	—	4.20	—
Maximum Special G Extra	0.85	0.20	0.25	4.20	9.75	—	—	2.40	—
Maximum Special	0.70	0.20	0.25	4.20	17.5	—	0.60	1.35	—
Maximum Special H	0.80	0.20	0.25	4.20	17.5	—	0.60	1.35	—
Maximum Special G = Maximum Special G3	0.82	0.20	0.25	4.20	7.75	—	—	2.00	—
Maximum Special MO	1.00	0.20	0.25	5.25	1.75	—	2.40	2.85	—
Maximum	0.70	0.25	0.25	4.00	17.5	—	0.60	0.50	—
000 Extra 6 = Maximum P	0.75	0.25	0.25	4.00	16.85	—	0.40	0.35	—
Maximum G	0.75	0.25	0.25	5.00	8.50	—	0.55	0.80	—
000 Extra	0.75	0.25	0.25	4.00	15.75	—	0.50	0.15	—
000	0.65	0.25	0.30	5.00	10.25	—	0.40	0.10	—

Chromium-Tungsten and Tungsten Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
301	0.32	0.35	0.30	2.25	9.50	—	—	0.25	2.40
KNO Extra	0.42	0.30	0.30	2.25	9.50	—	0.55	1.60	—
KNO	0.42	0.20	0.25	3.75	15.0	—	0.10	0.35	—
HPS	0.25	0.50	0.30	2.25	9.50	1.50	—	0.10	—
212	0.28	0.35	0.30	2.25	8.75	—	—	0.20	—
212 D2	0.30	0.35	0.30	2.75	4.35	—	—	0.55	—
425	0.30	0.35	1.10	1.45	3.75	—	—	—	—
425 D	0.32	0.35	1.10	2.45	1.90	—	—	0.35	—
Tenax NB	0.55	0.25	1.00	1.10	1.90	—	—	—	—
Tenax N = 895	0.45	0.25	1.00	1.10	1.90	—	—	—	—
Tenax NF	0.35	0.25	1.00	1.10	1.90	—	—	—	—
0 Diamanthart	1.35	0.25	0.20	0.55	4.90	—	—	0.35	—
0 Diamanthart D	1.35	0.25	0.20	0.70	3.35	—	—	0.35	—
0 Extra	1.35	0.25	0.20	0.25	4.75	—	—	0.10	—
0 Extra D	1.35	0.25	0.20	0.25	3.35	—	—	0.20	—
Solar	1.20	0.50	0.25	1.60	1.45	—	—	0.15	—
SPS	1.20	0.30	0.20	0.40	1.15	—	—	—	—
SP	1.20	0.30	0.20	—	0.70	—	—	—	—
SST	1.00	0.30	0.20	—	1.15	—	—	—	—
Duplex Extra	1.05	0.35	0.25	0.25	1.15	—	—	0.20	—

Chromium Special Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
2002 Special	1.85	0.30	0.30	12.5	0.75	—	—	0.30	—
2002	1.90	0.30	0.30	12.5	—	—	—	—	—
Magnet C	0.95	0.30	1.35	4.00	—	—	—	—	—
WP	0.40	0.65	0.25	2.50	—	—	0.60	0.45	—
GS 1	0.40	0.65	0.25	2.50	—	—	0.45	0.28	—
GS 2	0.42	0.65	0.30	2.50	—	—	0.28	—	—
GS 3	0.38	1.40	0.30	2.50	—	—	0.28	—	—
GS 4 = ML Special	0.33	1.90	0.25	3.75	—	—	—	0.18	—
B 200	0.38	1.90	0.25	3.75	—	—	—	0.18	—
LDM Special	0.28	0.30	0.35	2.50	—	—	0.60	0.28	—
LDM	0.25	0.30	0.35	1.20	—	—	0.65	—	—
LDM 2	0.22	1.00	0.25	1.20	—	—	0.28	—	—
LDM 3	0.20	1.40	0.25	1.90	—	—	0.26	—	—
LDM 3 Special	0.22	1.40	0.25	1.90	—	—	0.26	0.22	—
Decora	0.57	0.65	0.30	2.50	—	—	0.35	0.15	—
Decora W	0.52	0.65	0.30	2.50	—	—	0.35	0.15	—
CV-CZ-CZ Special	0.42	0.55	0.25	2.25	—	—	—	0.15	—
CX	0.30	0.30	0.90	2.45	—	—	—	0.35	—

Tool Steels With Nickel

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
LDH	0.30	0.30	0.35	0.70	—	4.25	1.50	—	—
TPA	0.32	0.50	0.25	1.00	—	4.00	0.70	—	—
LDH2	0.22	0.30	0.45	0.50	—	3.75	1.25	—	—
LDH3 Special	0.30	0.30	0.45	0.70	—	2.40	0.75	0.30	—
LDH4	0.28	0.30	0.45	0.70	—	1.10	0.35	—	—
LDH4 Special	0.30	0.30	0.45	0.70	—	1.40	0.45	0.22	—
LDH5	0.26	0.30	0.45	0.70	—	1.10	0.10	0.22	—
LDH5 Special	0.28	0.30	0.45	0.70	—	1.10	0.30	0.22	—
CNF	0.35	0.50	0.25	0.90	—	4.85	—	—	—
CNB	0.38	0.50	0.25	1.50	0.60	4.25	0.30	—	—
CNBD	0.38	0.50	0.25	1.50	—	3.50	—	—	—
CNB4	0.35	0.30	0.30	5.00	—	1.70	0.48	—	—
TBM Extra	0.40	1.10	0.40	1.10	—	1.70	0.48	—	—
TBM	0.48	0.80	0.40	0.90	—	1.70	0.28	—	—
CNH Special	0.55	0.50	0.25	0.75	—	2.60	—	—	—
CN Special	0.38	0.50	0.25	0.75	—	2.85	—	—	—
TI Special	0.12	0.45	0.25	1.10	—	4.10	—	—	—
TE Special	0.15	0.50	0.25	0.70	—	3.35	—	—	—
BZ	0.39	0.60	0.25	1.10	—	2.20	0.15	—	—

Tool Steels With Nickel and Manganese

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
Orlo	0.90	0.30	0.25	—	—	—	—	0.20	—
5HN	0.85	0.45	0.25	—	—	—	—	0.05	—
1888	0.70	0.55	0.25	—	—	—	—	0.05	—
Stabil Special	0.85	1.70	0.25	0.30	—	—	—	0.20	—
Stabil	0.80	2.10	0.25	—	—	—	—	0.15	—

Special and Extra Tool Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
FS Special	1.20	0.25	0.15	—	—	—	—	0.15	—
EZH Special	1.00	0.35	0.20	—	—	—	—	0.15	—
S Special	0.75	0.30	0.25	—	—	—	—	0.15	—
FS-148	1.10/1.20	0.30	0.20	—	—	—	—	—	—
FS[a]	1.40/1.20	0.25	0.15	—	—	—	—	—	—
EZH	0.95/1.05	0.30	0.20						
EZH[a]	0.95/1.05	0.25	0.15	—	—	—	—	—	—
Index	0.95/1.05	0.30	0.20	—	—	—	—	—	—
EZ	0.75/0.85	0.30	0.20	—	—	—	—	—	—
Deco	0.90/1.05	0.30	0.20	—	—	—	—	—	—

Tool, Drill and File Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
2	1.20/1.35	0.30	0.20	—	—	—	—	—	—
3	1.05/1.20	0.30	0.20	—	—	—	—	—	—
4	0.90/1.05	0.30	0.20	—	—	—	—	—	—
5	0.75/0.90	0.32	0.20	—	—	—	—	—	—
6	0.65/0.75	0.35	0.25	—	—	—	—	—	—
2[a]	1.20/1.35	0.25	0.15	—	—	—	—	—	—
3[a]	1.05/1.20	0.25	0.15	—	—	—	—	—	—
4[a]	0.90/1.05	0.25	0.15	—	—	—	—	—	—
C	1.20/1.35	0.30	0.20	—	—	—	—	—	—
D	1.05/1.20	0.30	0.20	—	—	—	—	—	—
E	0.90/1.05	0.30	0.20	—	—	—	—	—	—
F	0.75/0.90	0.30	0.20	—	—	—	—	—	—
S	0.70/0.80	0.30	0.12	—	—	—	—	—	—
KO	1.35/1.50	0.20	0.12	—	—	—	—	—	—
K1	1.20/1.35	0.25	0.12	—	—	—	—	—	—
K2	1.00/1.20	0.25	0.12	—	—	—	—	—	—

used for deoxidation, the average aluminum addition being four lb for a 10-ton heat. Both Edelstahle and Rochlingstahl cast tapered square ingots and tapered round ingots, the latter sometimes termed as "conical" ingots. The molds are open at both ends and set on a cast iron flat stool about six in. in thickness. The ingot size varied greatly, it apparently being the intent to cast small ingot as consistent with the size of the bar to be manufactured as possible. Ingots, therefore, varied from as small as 300 lb to as large as about eight tons. The molds were given a wash of hot tar and a hot top was used which consisted of a large cast iron ring into which was set a tapered clay container, either square or round in accordance with the shape of the ingot. Between the clay container and the cast iron ring mud was rammed. The whole was heated and placed on top of the mold before casting. The assembly was heated to a temperature of 600° C. The volume of the hot top generally contained about ten pct of the ingot volume. The standard square ingot at Rochlingstahl weighed 700 kilos with the cross section of 300 mm at the top and 240 mm at the bottom with a length of 1200 mm. The molds were usually round on the outside and the radius of the inside corner was quite large, being about three in. A mold for casting a 700 kilo ingot weighed 1100 kilos. The round ingots were usually of three weights: 200, 400 or 600 kilos with the major portion of the steel cast in a mold of the 400 kilo weight. The 400 kilo ingot had a top diameter of 300 mm, a bottom diameter of 235 mm with an ingot length of 800 mm, not including the hot top. The hot top for this ingot had a dimension of approximately 240 mm at the bottom, 160 mm at the top and a length of 300 mm. All ingots, regardless of composition, were annealed immediately after casting, the ingots apparently being kept at a comparatively hot temperature until they could be placed in the annealing furnaces. The hot beds were heated. After annealing practically all of the ingots were rough turned, the amount of surface removal varying somewhat with the composition of the steel. Turning equipment was available for both round and square ingots, the square ingots being turned on lathes manufactured by Waldrich of Siegen-Westfalen, and were of the profile type whereby the tool followed the contour of the ingot. On ingots weighing 1200 kilos it was possible to turn 12 ingots in eight hr of soft steel to five ingots in eight hr of hard steel such as high speed steel.

All highly alloyed steels and nearly all types of tool steels, with the exception of straight carbon steels, were hammered, while steels of the SAE type were pressed. At Rochlingstahl there was available one 1800-ton press,

Chromium Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
EX	1.40	0.50	0.30	1.60	—	—	—	0.15	—
CRI	1.25	0.70	1.15	1.20	—	—	—	—	—
DS Special	1.15	0.20	0.15	1.00	—	—	—	0.18	—
EPAZ	1.25	0.40	0.25	0.12	—	—	—	0.15	—
SC-REDI H	0.60	0.70	1.55	0.80	—	—	—	—	—
REDI = LDS	0.45	0.50	1.45	0.60	—	—	—	—	—
CR2	0.80	0.35	0.25	1.70	—	—	—	—	—
CR2W	0.70	0.35	0.25	1.70	—	—	—	—	—
CRI	0.90	0.35	0 25	1.00	—	—	—	0.10	—
CR	0.90	0.30	0.25	0.75	—	—	—	0.10	—
CRK	1.00	0.40	0.25	1.40	—	—	—	—	—
RCR = DS	1.20	0.20	0.15	1.00	—	—	—	—	—
RCR 1 = 1 Extrahart	1.50	0.25	0.20	0.75	—	—	—	—	—
3C	1.15	0.30	0.20	0.15	—	—	—	—	—

Corrosion Resisting Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Ti
Antoxyd	0.20	0.50	0.25	21.00	—	38.50	—	—	—	—
Antoxyd 2	0.10	0.45	0.50	21.00	—	38.50	5.50	—	—	0.50
AKC	0.20	0.50	0.50	24.00	—	19.50	—	—	—	—
AKCM	0.45	0.50	0.50	18.00	—	19.50	3.25	—	—	—
AKCR	0.15	0.50	1.00	25.00	—	14.50	—	—	—	—
AKCF	0.10	0.50	0.80	21.00	—	10.00	—	—	—	—
AKV Extra	0.07	0.50	0.50	18.50	—	9.00	1.65	—	—	—
AKV Extra S	0.07	0.50	0.80	18.50	—	8.50	1.65	—	—	0.60
AKV	0.15	0.50	0.80	18.50	—	9.00	—	—	—	—
AKVS	0.10	0.50	0.80	18.50	—	8.50	—	—	—	0.60
AKVN	0.10	0.50	0.80	18.50	—	9.00	—	—	—	—
AKVU	0.15	0.50	0.80	18.50	—	9.00	—	—	—	—
L-ADVD	0.40	1.00	2.30	18.00	1.20	9.50	—	—	—	—

Welding Rods

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
S2	1.20/1.35	0.30	0.05	—	—	—	—	—	—
S3	1.05/1.20	0.30	0.05	—	—	—	—	—	—
S4	0.90/1.05	0.30	0.05	—	—	—	—	—	—
S5	0.75/0.90	0.30	0.05	—	—	—	—	—	—
S6	0.65/0.75	0.30	0.05	—	—	—	—	—	—
Azzalon	0.75/0.85	0.30	0.05	—	—	—	—	—	—
SR2	1.20/1.35	0.30	0.20	—	—	—	—	—	—
SR3	1.05/1.20	0.30	0.20	—	—	—	—	—	—
SR4	0.90/1.05	0.30	0.20	—	—	—	—	—	—
SR5	0.75/0.90	0.32	0.20	—	—	—	—	—	—
SR6	0.65/0.76	0.35	0.25	—	—	—	—	—	—
T5 Extra	0.65/0.75	0.35	0.07	—	—	—	—	—	—
T5W Extra	0.52/0.60	0.70	0.25	—	—	—	—	—	—
T6H Extra	0.42/0.50	0.75	0.25	—	—	—	—	—	—
T6H B	0.48/0.54	0.55	0.20	—	—	—	—	—	—
MO	0.30/0.40	0.50	0.20	—	—	—	—	—	—

one hammer of 3000 kilo capacity, three hammers of 1500 kilo capacity, two hammers of 1000 kilo capacity, and a number of smaller ones. All heating was by the use of coke oven gas. Nothing unusual existed in the forged practice. The rolling mill equipment of the Rochlingstahl works consisted of one blooming mill, 650 mm rolls, three high-three stand, with a constant speed; one five stand, 400 mm, two high mill with a variable speed; one two high-seven stand, 300 mm mill with a constant speed; one two high-four stand, 250 mm, constant speed; and one billet mill, 420 mm, two stand-three high, with a constant speed. The two stand billet mill was placed about 40 ft in back and slightly to one side of the seven stand, 300 mm mill, so that billets reduced on the two stand billet mill could be taken direct to the seven stand mill without reheating. The largest size of high speed steel rolled at Rochlingstahl was approximately 40 mm in diameter and at Edelstahle the largest size was approximately

Corrosion Resistant Steels with Chromium and Manganese

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Ti
AKM	0.07	18.00	0.80	10.00	—	1.00	1.00	—	—	—
AKM 2	0.07	9.50	0.50	18.00	—	—	—	—	—	—
AKM 3	0.07	13.50	0.50	18.00	—	—	—	—	—	—
AKMF	0.09	15.50	0.50	13.00	—	1.00	—	—	—	—
AKMF 1	0.09	17.00	0.50	14.50	—	—	—	—	—	—
AKMF 2	0.09	17.50	3.00	8.50	—	—	—	—	—	—
L-AKMF 3	0.09	17.50	1.50	11.50	—	—	—	—	—	0.50
L-MS	0.29	18.00	0.50	1.30	—	—	—	—	—	—

Heat Resisting Chromium Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Ti
AKX8 L-AKX8	0.09	0.50	1.30	7.50	—	—	—	—	—	—
AKX	0.10	0.50	0.25	25.00	—	—	—	—	—	—
AKX Extra	0.10	0.50	0.50	25.00	—	4.70	—	—	—	—
AKX Special	0.09	0.50	0.50	25.00	—	5.50	1.70	—	—	0.40
AKX6	0.10	0.50	1.80	4.00	—	—	—	—	—	—
AKX12	0.09	0.50	1.00	26.00	—	—	—	0.30	—	0.50
AKX12 Special	0.09	0.50	1.00	23.50	0.50	1.30	0.40	0.25	—	0.20
GFE	0.60	0.50	0.50	25.00	—	—	—	—	—	—

Corrosion Special Steels

BRAND	C	Mn	Si	S	Cr	W	Ni	Mo	V	Cu	Ti
AK1	0.12	0.50	0.25	—	13.00	—	—	—	—	—	—
AK1W	0.07	0.50	0.25	—	13.00	—	—	—	—	—	—
AK1U	0.10	0.50	0.25	0.20	16.50	—	—	0.33	—	—	—
AK1B	0.10	0.50	0.25	—	16.00	—	0.30	0.20	—	1.80	—
AK1BS	0.10	0.50	—	—	15.20	—	—	—	—	—	—
AK1B Extra	0.09	0.50	0.50	—	17.50	—	—	—	—	—	0.50
AK1B Special	0.09	0.50	0.50	—	17.50	—	—	1.40	—	—	0.50
AK2, L-AK2	0.20	0.50	0.25	—	15.20	—	—	—	—	—	—
AK2 Special	0.22	0.50	0.25	—	15.20	—	—	—	—	—	—
AK2S	0.22	0.50	0.25	—	13.00	—	—	—	—	—	—
AK3S	0.33	0.50	0.25	—	13.00	—	—	—	—	—	—
AK4	0.40	0.50	0.25	—	14.00	—	—	—	—	—	—
AK5	—	—	—	—	—	—	—	—	—	—	—
AK Special	0.47	0.40	0.25	—	15.20	—	—	—	—	—	—
AK5M, L-AK5M	0.42	0.50	0.25	—	14.80	—	—	1.85	—	—	—
AKH	1.00	0.50	0.25	—	14.50	1.80	—	—	—	1.35	—
702	0.45	0.40	3.00	—	8.50	—	—	—	—	—	—
702M	0.47	0.25	2.80	—	9.50	—	0.40	0.85	—	—	—
702D	0.45	0.40	3.10	—	8.50	—	—	—	—	—	—

Corrosion Resisting Steels with Special Physical Properties

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Cu	Ti
AKR L-AKR	0.45	0.60	1.50	12.50	2.20	12.50	—	—	—	—
L-AKRD	0.45	0.75	1.50	15.00	2.30	13.00	—	—	—	—
AKRV	0.28	0.60	1.50	12.50	2.20	12.50	0.50	1.00	—	—
AKRVB	0.18	0.50	0.50	12.50	2.20	12.50	—	1.00	—	—
KAPTOR	0.35	0.60	1.50	12.50	2.60	12.50	—	1.25	—	—
KAPTOR D	0.35	16.00	0.40	13.50	3.20	—	—	—	—	—
AKL	0.08	0.50	0.25	14.00	—	10.80	—	—	—	—
AKL1	0.15	0.60	0.30	12.30	—	10.50	—	—	—	—
AKS	0.35	0.50	0.25	4.50	—	22.00	—	—	—	—
AKS2	0.10	0.50	0.50	4.80	2.00	25.00	3.50	—	2.50	—
AK	0.15	0.50	0.25	—	—	9.50	—	—	—	—
N136	0.10	0.35	0.20	—	—	35.50	—	—	—	—
N125	0.45	0.50	0.25	—	—	25.50	—	—	—	—

Chromium-Nickel Special Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
AM	0.70	8.90	0.30	3.15	—	7.70	—	—	—
AMA	0.70	8.50	0.30	2.25	—	7.75	—	—	—
AMD	0.70	13.50	0.80	3.50	—	3.25	—	—	—
AM40	0.70	8.50	0.30	1.25	—	7.75	—	—	—
AMK	0.40	18.00	0.30	3.30	—	—	—	—	—
AMS	0.55	5.25	0.50	3.55	—	12.15	—	—	—
IHN	0.34	0.65	1.80	0.15	—	1.85	—	—	—
NIS	0.38	0.60	1.90	0.45	—	3.45	—	—	—
NIS2	0.36	0.60	1.90	1.70	0.50	2.20	—	—	—
NISC	0.34	0.60	1.80	1.10	—	2.40	—	—	1.30
TPE	0.28	0.40	0.25	1.50	0.50	3.00	0.30	—	—
Aquila L-Aquila	0.09	0.50	0.25	1.00	—	4.20	0.35	—	—
L-Aquila Extra D	0.16	0.55	0.25	1.55	—	1.75	0.23	—	—
	0.16 0.20	0.40 0.60	0.35	1.80 2.20	—	1.80 2.30	0.15 0.25	—	—
Victrix Special L-Victrix Special	0.15	0.50	0.25	1.00	—	3.65	0.35	—	—
Victrix Special 32 L-Victrix Special 32	0.26	0.50	0.25	0.75	0.65	3.40	0.30	—	—
Victrix Extra	0.22	0.50	0.25	1.95	—	1.95	0.25	—	—
L-Victrix Extra	0.26	0.50	0.25	2.45	—	1.75	0.23	—	—
L-Victrix Extra D	0.26 0.34	0.30 0.80	0.50	2.30 2.70	—	1.30 1.80	0.15 0.25	0.10 0.25	—
Bos L-Bos	0.39	0.60	0.25	1.10	—	2.00	0.15	—	—

50 mm. The larger sizes were hammer finished, and the largest hammer finish in high speed steel was generally about 125 mm in diameter. Sizes above this were made of upset forgings. The largest size of carbon and low alloy tool steel that was rolled at either Rochlingstahl or Edelstahle was usually in the vicinity of 150 mm with larger sizes hammer finished. The smallest hot rolled sizes were 5.3 mm and these were usually coiled for the wire mill.

The sheet rolls at Rochlingstahl consisted of one three stand mill, the two outer rolls of which were 700 mm in diameter and the middle roll was 500 mm in diameter. This mill was capable of rolling sheets with a maximum of 1200 mm diameter and a maximum length of 3000 mm. The finishing sheet mill consisted of a two high mill with 700 mm diameter rolls capable of rolling a 1200 mm sheet.

Chromium-Nickel Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Cu
CNL L-CNL	0.30	0.40	0.25	0.85	—	4.80	—	—	—	—
DIN 1662: VCN 45	0.30/0.40	0.40/0.80	0.35	1.10/1.50	—	4.25/4.75	—	—	—	—
Fliegw. 1420	0.40	0.80	0.35	1.50	—	3.75/4.75	—	—	—	—
CNLW L-CNLW	0.27	0.40	0.25	0.85	—	4.50	—	—	—	—
TEIN	0.14	0.45	0.25	1.10	—	4.50	—	—	—	—
L-TEIN	0.10/0.17	0.50	0.35	0.90/1.30	—	4.25/4.50	—	—	—	—
TEI L-TEI	0.12	0.45	0.25	1.05	—	4.05	—	—	—	—
TEM	0.12	0.45	0.25	0.75	—	3.35	—	—	—	—
L-TEM	0.10/0.17	0.50	0.35	0.55/0.95	—	3.25/3.75	—	—	—	—
TEMW L-TEMW	0.09	0.45	0.25	0.50	—	3.15	—	—	—	—
CNS	0.33	0.60	0.25	0.80	—	3.35	—	—	—	—
L-CNS	0.27/0.35	0.40/0.80	0.35	0.55/0.95	—	3.25/3.75	—	—	—	—
CNSW	0.25	0.45	0.25	0.80	—	3.35	—	—	—	—
L-CNSW	0.20/0.27	0.40/0.80	0.35	0.55/0.95	—	3.25/3.75	—	—	—	—
VCN	0.36	0.60	0.25	0.80	—	2.35	—	—	—	—
L-VCN	0.32/0.40	0.40/0.80	0.35	0.55/0.95	—	2.25/2.75	—	—	—	—
VCNW	0.29	0.45	0.25	0.80	—	2.35	—	—	—	—
L-VCNW	0.25/0.32	0.40/0.80	0.35	0.55/0.95	—	2.25/2.75	—	—	—	—
ECN	0.13	0.45	0.25	0.80	—	2.35	—	—	—	—
L-ECN	0.10/0.17	0.50	0.35	0.55/0.95	—	2.25/2.75	—	—	—	—
ZY	0.30	0.60	0.25	0.90	—	1.95	—	—	—	0.30
	0.25/0.55	0.80	0.40	0.50/1.50	—	1.80/2.50	—	—	—	0.30
CNC	0.33	0.75	0.255	4.75	—	1.70	—	—	—	—
CNI	0.18	0.60	0.25	2.00	—	1.70	—	—	—	—
L-CNI	0.16/0.22	0.50/0.80	0.40	1.80/2.20	—	1.60/1.80	—	—	—	—
CNE	0.14	0.60	0.25	1.35	—	1.55	—	—	—	—
TBOS	0.50	0.60	0.25	0.80	—	1.45	—	—	—	—
BO 4	0.35	0.45	0.25	0.60	—	1.45	—	—	—	—
L-BO 4	0.32/0.40	0.40/0.80	0.35	0.30/0.70	—	1.25/1.75	—	—	—	—
	0.33/0.40	0.80	0.35	0.25/0.75	—	1.75	—	—	—	—
BO 3	0.28	0.60	0.25	0.65	—	1.45	—	—	—	—
L-BO 3	0.25/0.32	0.40/0.80	0.35	0.30/0.70	—	1.25/1.75	—	—	—	—
	0.32	0.80	0.35	0.25/0.75	—	1.75	—	—	—	—
BO 2	0.24	0.45	0.20	0.65	—	1.15	—	—	—	—
BE	0.12	0.50	0.25	0.70	—	1.45	—	—	—	—

Nickel and Tungsten Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
TY5M	0.20	0.50	0.25	—	—	4.85	—	—	—
TY5W	0.12	0.50	0.25	—	—	4.85	—	—	—
L-TY5W	0.10	0.50	0.25	—	—	4.85	—	—	—
TY4M	0.27	0.60	0.20	0.20	—	4.00	—	—	—
TY3H	0.32	0.60	0.25	—	—	3.00	—	—	—
TY3M L-TY3M	0.23	0.60	0.25	—	—	3.00	—	—	—
TY3W	0.12	0.50	0.25	—	—	3.00	—	—	—
L-TY3W	0.09	0.50	0.25	—	—	3.00	—	—	—
TY1W L-TY1W	0.11	0.40	0.25	—	—	1.35	—	—	—
WO1	0.65	0.45	0.25	—	1.10	—	—	—	—
WO2	0.65	0.45	0.25	0.25	2.00	—	—	—	—
WO3	0.85	0.30	0.20	0.40	3.00	—	—	—	—
WO3 Special	0.85	0.60	0.30	0.50	3.25	—	0.35	0.15	—
WO3H Special	1.00	0.65	—	0.55	3.25	—	0.50	0.25	—

Chromium-Molybdenum-Vanadium and Chromium-Molybdenum Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Cu
CVM1	0.40	0.65	0.25	2.50	—	—	0.45	0.28	—	—
CVM2	0.43	0.65	0.25	2.50	—	—	0.28	0.28	—	—
CVM	0.40	0.85	0.25	1.75	—	—	0.18	0.22	—	—
	0.38/0.45	0.70/1.00	0.40	1.60/1.90	—	—	0.15/0.20	0.15/0.25	—	—
L-CVMW	0.27	0.60	2.25	2.50	—	—	0.23	0.20	—	—
	0.24/0.34	0.40/0.80	0.40	2.30/2.70	—	—	0.15/0.25	0.10/0.35	—	—
CKVM	0.65	0.45	0.25	1.00	—	—	0.40	0.20	—	—
Hubertus	0.15	0.50	0.25	5.50	—	—	0.60	—	—	1.00
1555	0.12	0.45	0.35	5.00	—	—	0.43	—	—	—
HD50	0.17	0.60	0.25	0.90	—	—	0.50	—	—	—
	0.20	—	—	1.00	—	—	0.50	—	—	—
CM6L	0.37	1.40	0.30	2.50	—	—	0.28	—	—	—
L-CM6L	0.37/0.45	1.00/1.20	0.50	2.00/2.30	—	—	0.30	—	—	—
CM6	0.32	0.70	0.25	1.85	—	—	0.20	—	—	0.30
	0.25/0.45	0.80	0.40	1.60/2.80	—	0.50	0.15/0.35	—	—	0.30
CM 5	0.42	0.70	0.25	1.10	—	—	0.23	—	—	—
L-CM5	0.38/0.45	0.50/0.80	0.35	0.90/1.20	—	—	0.15/0.25	—	—	—

Chromium-Molybdenum Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
CM 4	0.33	0.60	0.25	1.10	—	—	0.23	—	—
L-CM4	0.30/0.37	0.50/0.80	0.35	0.90/1.20	—	—	0.15/0.25	—	—
L-CM4W	0.30	0.50	0.25	3.05	—	—	0.40	—	—
CM 3	0.30	0.60	0.25	1.10	—	—	0.20	—	—
	0.22/0.29	0.50/0.80	0.35	0.90/1.20	—	—	0.15/0.25	—	—
L-CM 3	0.25	0.60	0.15	1.10	—	—	0.20	—	—
	0.22/0.28	0.70	0.35	0.90/1.20	—	—	0.15/0.25	—	—
CM 2	0.20	1.05	0.25	1.20	—	—	0.23	—	—
L-CM2	0.18/0.23	0.90/1.20	0.35	1.10/1.40	—	—	0.20/0.30	—	—
	0.18/0.23	0.90/1.20	0.40	1.10/1.40	—	—	0.15/0.25	—	—
CE-L-CE	0.10	0.55	0.25	0.75	—	—	—	—	—
	0.12/0.18	0.40/0.60	0.40	0.60/0.90	—	—	—	—	—
CA	0.13	0.55	0.25	0.40	—	—	—	—	—
	0.10/0.16	0.40/0.60	0.40	0.30	—	—	—	—	—

Chromium-Silicon and Silicon Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
SCH 1	0.65	0.70	1.65	0.85	—	—	—	—	—
SCH	0.55	0.70	1.45	0.60	—	—	—	—	—
SCW	0.45	0.50	1.45	0.60	—	—	—	—	—
ESL	0.45	0.50	1.80	—	—	—	—	—	—
ESH 1	0.65	0.75	1.75	—	—	—	—	—	—
	0.60/0.70	0.50/0.90	1.40/1.90	—	—	—	—	—	—
ESH	0.55	0.75	1.60	—	—	—	—	—	—
	0.50/0.60	0.50/0.90	1.40/1.90	—	—	—	—	—	—
ESW 2	0.45	0.60	1.65	—	—	—	—	—	—
	0.40/0.55	0.50/0.75	1.50/1.80	—	—	—	—	—	—

Nitriding Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Al
AL 12 L-AL 12	0.33	0.45	0.25	1.50	—	1.00	0.18	—	—	1.10
AL 14 L-AL 14	0.44	0.55	0.25	1.50	—	—	0.23	—	—	0.95
AL 16 L-AL 16	0.35	0.75	0.30	1.65	—	—	—	—	—	1.10
	0.28/0.38	0.50/0.90	0.40	1.30/1.90	—	—	—	—	—	0.90/1.30
AL 30 L-AL 30	0.32	0.70	0.30	1.10	—	—	0.18	—	—	1.15
	0.28/0.38	0.50/0.90	0.40	0.90/1.30	—	—	0.15/0.25	—	—	0.90/1.30
NIT	0.27	0.60	0.30	2.50	—	—	0.25	0.20	—	—
L-NIT 2	0.24/0.34	0.40/0.80	0.40	2.30/2.70	—	—	0.20/0.30	0.15/0.35	—	—
NIT 4	0.27	0.55	0.30	2.50	—	—	—	0.26	—	—
L-NIT 4	0.24/0.34	0.40/0.80	0.40	2.30/2.70	—	—	—	0.20/0.35	—	—

Chromium-Manganese and Manganese Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
2526	0.36	1.70	0.25	0.30	—	—	—	—	—
TO Extra Simplex	0.80	1.00	0.60	0.40	—	—	—	—	—
T2 Extra	0.56	0.90	0.40	0.50	—	—	—	—	—
T6H Extra T	0.44	0.90	0.30	0.25	—	—	—	—	—
Extra TH	1.10	0.40	0.25	0.45	—	—	—	—	—
L MV4	0.42	1.70	0.30	—	—	—	—	0.15	—
	0.38/0.45	1.50/2.00	0.40	—	—	—	—	0.10/0.20	—
L-M15	0.16	2.20	0.45	—	—	—	—	—	—
	0.12/0.20	2.00/2.40	0.30/0.60	—	—	—	—	—	—
SCM	0.45	1.80	0.30	—	—	—	—	—	—
	0.45/0.55	1.50/2.00	0.40	—	—	—	—	—	—
2526N	0.36	1.70	0.30	—	—	—	—	—	—
	0.33/0.40	1.60/1.90	0.40	—	—	—	—	—	—
L-M10	0.16	1.20	0.35	—	—	—	—	—	—
	0.11/0.20	1.00	0.50	—	—	—	—	—	—
2514	0.33	1.35	0.30	—	—	—	—	—	—
	0.28/0.35	1.20/1.50	0.40	—	—	—	—	—	—
2518	0.37	1.25	1.25	—	—	—	—	—	—
	0.33/0.40	1.10/1.40	1.10/1.40	—	—	—	—	—	—

Austenitic Manganese Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co
HS	1.30	13.75	0.25	—	—	—	—	—	—
HS Special	1.30	13.75	0.25	—	—	2.75	—	—	—
HS2	0.70	15.50	0.25	—	—	—	—	—	—

Steels of the Komotau Works

Special Steels

BRAND	C	Mn	Si	Cr	W	Ni	Mo	V	Co	Cu
Poldi Works Steels										
AK1B-GuB	0.20	0.60	0.75	16.00	—	—	0.40	—	—	1.7
AK1BS-GuB	0.20	0.60	0.75	16.00	—	0.40	0.20	—	—	—
AKX Special GuB	0.50	0.60	1.15	27.00	—	9.00	0.40	—	—	—
AKX Special 1-GuB	0.28	0.60	1.15	27.00	—	9.00	0.40	—	—	—
AKX Special M-GuB	0.50	0.60	1.15	27.00	—	9.00	2.00	—	—	—
AKX Special 1 M-GuB	0.28	0.60	1.15	27.00	—	9.00	2.00	—	—	—
AKX Special 20-GuB	0.40	0.60	0.75	21.00	—	10.00	—	—	—	—
AKX Special F-GuB	0.40	0.60	0.75	26.00	—	14.00	—	—	—	—
AKX-GuB	0.60	0.60	0.75	25.00	—	—	—	—	—	—
AKX 20-GuB	0.60	0.60	1.70	20.00	—	—	—	—	—	—
AKX Extra-GuB	2.20	0.50	0.65	28.00	—	—	—	—	—	—
AKX 28-GuB	1.20	0.40	1.25	27.00	—	3.50	—	—	—	—
AKX 30-GuB	1.20	0.40	1.25	30.00	—	—	—	—	—	—
AKX 30 M-GuB	1.20	0.40	1.25	30.00	—	—	1.75	—	—	—
Extra F-GuB	1.70	0.40	0.40	18.00	1.25	1.40	—	—	—	—
Extra C3-GuB	1.90	0.40	0.40	18.00	1.25	1.40	—	—	2.75	—
ZR-GuB	2.10	0.40	0.40	21.00	1.75	1.00	—	0.40	—	—

The third sheet mill was a two high mill having 700 mm diameter rolls but somewhat more narrow in width than the other two mills, this mill being capable of rolling a sheet 1000 mm in width. The Edelstahle, in addition to hot rolling sheet mills, had one mill for cold rolling which was capable of rolling sheets 1000 mm in width. The cold drawn division of Rochlingstahl appeared comparatively small, even though the management stated that the mill had a capacity of approximately 200 tons per month. The Rochlingstahl mill contained only four centerless grinders and were grinding wire, or bars, within the limits of two mm and 25 mm. The mill contained a large number of benches for wire drawing, most of them having drums individually driven. The Edelstahle contained a much larger wire drawing department than that of Rochlingstahl, even though the equipment was quite similar. The Rochlingstahl works contained no tube mill, while Edelstahle had a tube mill of large size and capable of pro-

Poldi Works Steels	C	Mn	Si	P	S	Cr	W	Ni	Mo	V	Cu
No Cobalt in the following steels:											
UG2-GuB	0.20	0.80	0.40	0.06	0.04/0.08	—	—	—	—	—	—
UG3-GuB	0.30	0.80	0.40	0.06	0.04/0.08	—	—	—	—	—	—
UG4-GuB	0.40	0.80	0.40	0.06	0.04/0.08	—	—	—	—	—	—
UG5-GuB	0.52	0.80	0.40	0.06	0.04/0.08	—	—	—	—	—	—
UG4-Extra-GuB	0.40	0.80	1.60	0.06	0.04/0.08	—	—	—	—	—	—
UG5 Extra-GuB	0.52	0.80	1.60	0.06	0.04/0.08	—	—	—	—	—	—
LG2V-GuB	0.20	0.80	0.40	0.06	0.04/0.08	—	—	—	—	—	—
LG2M-GuB	0.20	0.80	0.40	0.06	0.04/0.08	—	—	—	0.40	—	—
LG4-GuB	0.32	1.70	0.40	0.06	0.04/0.08	0.30	—	—	—	—	—
LG4V-GuB	0.28	1.70	0.40	0.06	0.04/0.08	0.60	—	—	0.20	—	—
LG4M-GuB	0.28	1.70	0.40	0.06	0.04/0.08	0.60	—	—	0.25	—	—
CM3-GuB	0.30	0.65	0.40	0.06	0.04/0.08	1.00	—	—	0.20	—	—
CM3 Extra-GuB	0.30	0.65	0.40	0.06	0.04/0.08	1.00	—	—	0.50	—	—
BO4-GuB	0.33	0.70	0.35	0.06	0.04/0.08	0.70	—	1.50	—	—	—
BOZ-GuB	0.40	0.70	0.35	0.06	0.04/0.08	1.00	—	2.00	0.20	—	—
CNL-GuB	0.20	0.70	0.35	0.06	0.04/0.08	0.90	—	4.80	—	—	—
HS-GuB	1.35	13.00	0.40	0.10	0.04	—	—	—	—	—	—
HS Special-GuB	1.35	13.00	0.40	0.10	0.04	—	—	1.25	—	—	—
AKV-GuB	0.20	0.60	1.15	0.04	0.04	19.0	—	9.00	0.20	—	—
AKVH-GuB	0.32	0.60	1.15	0.04	0.04	22.0	—	9.00	0.20	—	—
AKV Extra-GuB	0.20	0.60	1.15	0.04	0.04	19.00	—	9.00	1.75	—	—
AKV Extra H-GuB	0.32	0.60	1.15	0.04	0.04	22.0	—	9.00	1.75	—	—
AKRV-GuB	0.22	0.50	0.50	0.04	0.04	13.00	2.00	13.0	—	1.00	—
No Cobalt in the following steels:											
Poldi Works Steels											
AKS-GuB	0.38	0.50	0.42	0.04	0.04	4.50	—	21.80	—	—	—
AKS2-GuB	0.20	0.50	1.25	0.04	0.04	4.75	2.00	25.00	3.50	—	4.0
AKC-GuB	0.30	0.60	1.15	0.04	0.04	24.00	—	20.5	—	—	—
Antoxyd-GuB	0.35	0.60	1.15	0.04	0.04	21.00	—	38.5	—	—	—
Antoxyd 2-GuB	0.20	0.60	1.15	0.04	0.04	21.00	—	38.5	5.00	—	3.00

Steels of the Edelstahlwerke Works

High Speed Steels

Cobalt-Tungsten-Vanadium

	C	Cr	Mo	V	Mo	Co
Cobalt II	0.80	4.25	0.65	2.23	12.50	5.00
Cobalt III	0.80	4.25	0.65	2.25	12.50	2.75
*Cobalt III N	0.80	4.25	0.65	2.00	10.00	2.50

Tungsten-Vanadium

	C	Cr	Mo	V	Mo	Co
SA 200	0.85	4.00	0.30	2.50	10 to 11	—
SA 500	1.35	4.25	0.30	4.30	10 to 11	—
SA 900	1.50	4.25	0.65	4.25	12.50	5.00
000 Spezial 31	0.80	4.00	0.30	2.60	10.00	—

Low Tungsten

	C	Cr	Mo	V	Mo
*Rapid Spezial BN	0.80	4.00	0.30	1.60	8.00 to 10
Mo 325 X	0.90 to 10	4.00	2.50	2.50 to 3.00	2.20 to 2.50
Mo 1225 X	0.90 to 10	4.00	2.50	2.50 to 3.00	1.00 to 1.5

* Indicates made recently.

High alloy tool steels for extrusion purposes

	C	Cr	Va	Mo
Spezial W	0.30	2.50 to 2.75	0.30 to 0.50	8.00 to 9.00
W 2	0.30	2.20 to 2.50	0.30 to 0.50	1.80 to 2.00
W 5	0.30	2.20 to 2.50	2.30 to 0.50	4.00 to 5.00
Diamant 3	1.35	0.10	0.10	2.00 to 2.50
5 (x)	1.30	0.20	—	4.75

Blanking Die Steels

	C	Mn	Cr	Mo	Va
Bora	2.00	0.40	12.00	0.70	—
Bora Spezial	1.60	0.40	12.00	—	0.20
Goliath Spezial	bis2.10	0.40	12.00	—	—
Goliath	2.00	0.40	12.00	—	—

Steels for Battering Tools

	C	Si	Mn	Cr	Va	Mo
Durax Spezial	0.25	0.50	0.50	1.10	0.10	3.75
Durax W 2	0.45	0.90	0.35	1.20	— ca	2.00
Durax W 3	0.35	0.90	0.35	1.20	— ca	2.00
Durax H	0.55	0.50	0.35	1.25	0.40 ca	2.00
CaV 1	0.60	0.90	0.90	1.35	0.15	—
CaV 2	0.50	1.50	0.75	1.20	0.15	—
CaV 3	0.35	1.50	0.70	1.10	0.15	1.5 to 7
E 612	0.40	1.00	0.40	5.25	0.15	3.75
E 975	0.45	0.30	0.75	2.50	0.20	—

Chromium-Tungsten for Trimming Dies

	C	Si	Cr	W
Veresta	1.00	0.25	1.00	1.00

High Speed Steels (Continued)

Low Tungsten Tool Steels

	C	Si	Mn	Cr	Mo
WSPS	0.75	0.35	0.35	0.30	0.70
WS P	1.20	0.25	0.30	0.15	1.00
TP	1.00	0.20	0.30	0.10	0.9 (-WSW)
MSA	0.80	0.30	0.30	—	0.60

Chromium Tool Steels

	C	Si	Mn	Cr	Va
Veresta Spezial	1.40	0.25	0.70	1.40	—
K S	1.20	0.25	0.35	1.40	—
CRM	1.00	0.25	1.10	0.60	—
CRM Spezial	1.00	0.25	1.10	1.00	—
CRS	1.40	0.25	0.30	0.50	—
CRW	0.90	0.40	0.30	1.70	—
CSA	0.60	1.60	0.60	0.80	—
CSP	1.20	0.25	0.20	0.50	—
SCS P	1.25	1.15	0.70	1.20	—
LZ D 3	0.30	0.90	0.30	2.35	0.40
BKS 3	0.85	0.40	0.60	0.20 to 0.40	—

General Purpose Steels

	C	Si	Mn	Cr	W
B MS	1.15	0.25	0.35	1.10	1.10
MAS	0.55	0.90	1.20	—	—
SA	0.60	1.80 to 2.0	0.90	—	—

Drop Forging Die Steels

	C	Si	Mn	Cr	Ni	Mo
AMS	0.55	0.30	0.50 to 0.80	0.60	1.50	0.15 to 0.20
AMS Extra	0.55	0.30	0.80	0.75	1.50 to 1.80	0.40 to 0.60
CMS	0.45	0.35	1.30	1.80 to 2.00	—	0.20 to 0.30
CNS 2 H	0.25 to 0.30	0.30	0.40	1 to 1.30	4.50	0.30 to 0.50
		0.30	0.60			0.30 to 0.50

Jaw Steels

	C	Si	Mn
SS 1-6	1.40 to 0.70	0.25	0.25
NPU	1.00	0.25	0.20
Best	1.00	0.20 to 0.30	0.40 to 0.50

Ball and Ball Race Steels

	C	Si	Mn	Cr
SK 1	1.20	0.30	0.30	0.45 to 0.60
SK 3	0.05	0.30	0.30 to 0.90	1.00
SKL	1.00	0.30	0.40	1.50 to 1.60

Steels for Use With Heat and Hydrogen

Medium High Temperature Steels

	C	Si	Mn	Cr	V	Mo
CV 30	0.30	0.30	0.20	1.00	—	0.20
CV 60	0.30	0.30	0.40	1.35	—	0.55
CV 70	0.15	0.30	0.40	1.00	0.25	0.30
CV 110	0.30	0.30	0.40	1.40	—	1.10
CV 120	0.30	0.30	0.40	1.40	0.40	0.55

Steels for Medium High Temperature

	C	Si	Mn	Cr	Mo	Va	Mo
HC 5	0.10	0.35	0.40	2.50 to 2.75	—	—	—
HC 8	0.25	0.35	0.40	2.50 to 2.75	—	—	—
HC 9	0.20	0.35	0.40	3 to 3.25	0.25	0.50	—
MC I. II V	0.20	0.30	0.40	2.50 to 2.75	0.40	0.80	0.40

Steels for Use With Heat and Hydrogen

Stainless and Acid Resisting Steels

	C	Si	Mn	Cr	Mo
Remanit 1510	0.15	0.60	0.40	14.00	—
1520	0.20	0.33	0.50	13.50	0.50
1540	0.40	0.30	0.40	13.50	—

	C	Si	Mn	Cr	Mo
1610	0.10	0.60	0.40	18.00	—
1610 S	0.10	0.50	0.40	18.00	— + Ti
1620	0.25	0.30	0.40	16.50	1.50
1710 A	0.12	0.30	0.60	16.50	0.20 + S
1710 S	0.10	0.50	0.40	18.00	1.80 + Cb Ta 0.7

	C	Si	Mn	Cr	Va
1690	1.00	0.30	0.40	17.50	—
1690 V	0.85	0.30	0.40	18.00	0.50

	C	Si	Mn	Cr	Ni	Mo
1880	0.10	0.50	0.40	18.00	8.50	—
1880 S	0.10	0.50	0.40	18.00	8.50	— + Cb + Ta
1880 SS	0.10	0.50	0.40	18.00	9.50	2.00
1880 T	0.10	0.60	0.40	18.0	9.50	— N_2 — 0.1
1990 S	0.10	1.70	0.40	18.00	8.50	—
1990 SS	0.10	2.40	0.40	18.00	9.50	2.00

Welding Rod Steels

	C	Si	Mn	Cr	Ni	Mo	Cb
Thermanit A (17)	0.10	1.20	0.40	19.50	9.00	2.00	1.50
C	0.10	2.20	1.25	23.00	16.50	—	—
D	0.15	1.75	1.25	22.50	9.50	—	—
G	0.05	0.50	0.40	18.00	9.00	2.00	—
J	0.05	0.50	0.40	18.50	8.00	—	—
K	0.15	0.55	0.60	13.5	—	—	—
L	0.20	0.50	0.50	25.00	3.00	—	—
X	0.10	0.50	5.00 to 6.00	18.00	7.00	—	—

For Very High Temperatures

Heat-Resisting Steels

	C	Si	Mn	Cr	Ni	
Thermax 8 F	0.10	2.75	1.00	3.25	—	+ Ti
9 F	0.10	2.75	1.00	6.75	—	+ Ti
10 F	0.10	2.75	1.00	13.50	—	+ Ti
11 FN	0.2	0.5	0.65	25.00	2.50 to 3.00	
12 F	0.15	1.75	1.00	25.00	0.50	

Heat-Resisting Steels

	C	Si	Mn	Cr	Ni
Thermax 10A	0.10	2.35	1.25	19.00	10.00
11 A	0.15	2.30	1.25	23.50	19.50

Low Grade Welding Rod Steels

	C	Si	Mn	Cr	Ni
Thermax 9 AM	0.10	3.50	14.00	9.00	— + N_2
10 AM	0.10	3.50	18.50	9.50	1.75 + N_2

Valve Steels

	C	Si	Mn	Ni	Cr	Va	Mo
Silchrom II	0.40	4.00	0.30	—	3.00	—	—
Silchrom II	0.40	3.50	0.50	—	9.50	—	—
Gs	1.60	0.40	0.35	—	12.00	—	—
GSE	0.45	1.50	0.70	13.00	15.00	—	1.25
GSM	0.40	2.25	15.5	—	12.50	—	—
V 444 D	0.40	2.45	1.00	10.00	18.50	1.50	—

ducing tubes as large as eight in. O.D. Apparently much of the tubing produced by Edelstahle was for bearings.

The Rochlingstahl works contained a battery of approximately 15 annealing furnaces, the largest of which was capable of holding about 20 tons. All tool and high speed steels were packed and sealed in pipes with no packing compound being used, and the openings in the end of the pipes were merely "mudded" in. The pipes were quite large, being approximately 350 mm in diameter and were made of low carbon steel. Nearly all of the annealing furnaces were of the car type and all were gas fired. The pipes were supported in the furnace on cast iron cradles lifting the pipes about six in. from the furnace bottom. Only a few pipes were charged in each furnace, the number usually being from three to six. General practice seemed to be to heat the steel to the desired annealing temperature, after which it was held for about eight hr and then cooled with the furnace. About 24 hr was the usual period for cooling.

Materials Manufactured

All of the five companies mentioned manufactured ma-

Steels for Very High Temperatures

Magnet Steels

	C	Si	Mn	Cr	Mo	Co	We
Magnet C	1.00	0.25	0.25	3.30	—	—	—
CM	0.95	0.25	1.10	5.00	—	—	—
Kobalt 125	1.00	0.30	1.10	8.50	1.25	6.25	—
160	1.00	0.30	0.30	8.50	1.50	10.50	—
200	1.00	0.25	0.25	8.50	1.50	15.50	—
300	0.90	0.25	0.25	4.50	0.30	30.00	4.50
	C	**Si**	**Mn**	**Cr**	**Mo**	**Va**	**Al**
Nitrodur 81	0.36	0.36	0.70	1.40	—	—	1.10
90	0.30	0.30	0.70	2.50	0.20	0.20	—
91	0.30	0.30	0.70	2.50	—	2.50	—

Tool Steels

Carbon Tool Steels

BRAND	C	Si	Mn	P	S	Cr	Ni	Mo	V	Ti
A17G	0.80/0.90	0.25/0.40	0.45/0.60	0.025	0.02	—	—	—	—	—
BFV	0.65/0.70	0.15/0.25	0.50/0.60	0.025	0.025	—	—	—	—	—
WW	0.04	0.01	0.14	0.015	0.025	0.05	0.15	—	—	—

Alloy Tool Steels

BMH	0.42/0.48	1.50/1.70	1.50/0.70	0.05	0.05	—	—	—	—	—
WB97M	0.42/0.48	1.00/1.30	0.70	0.045	0.045	—	—	—	—	—
B126P	0.62/0.68	1.50/1.70	0.70	0.025	0.025	—	—	—	—	—
WB136M	0.68	1.70	0.70	0.045	0.045	—	—	—	—	—
BC1244	0.57/0.63	0.90/1.10	0.90/1.00	0.04/0.07	0.04	—	—	—	—	—
WBC1255	0.60/0.70	1.00/1.30	0.90/1.20	0.04/0.07	0.04	—	—	—	—	—
BDF30	0.30/0.36	0.80/1.00	0.25/0.35	0.025	0.02	0.90/1.10	—	—	0.15/0.20	W 1.70/2.00
BDF50	0.40/0.46	0.80/1.00	0.25/0.35	0.025	0.02	0.90/1.10	—	—	—	1.70/2.00
BDF Spezial	0.54/0.60	0.80/1.00	0.85/1.00	0.025	0.02	—	—	—	—	1.70/2.00
WBF1552	0.67/0.73	1.20/1.40	0.45/0.60	0.035/0.06	0.035	0.40/0.55	—	—	—	—
BF2555	1.20/1.30	1.05/1.25	0.60/0.80	0.03/0.05	0.03	1.10/1.30	—	—	—	—
BFG	0.90/0.95	1.05/1.25	0.60/0.80	0.03/0.05	0.03	1.10/1.30	—	—	—	—
BFM755 WA650	0.32/0.38	1.40/1.60	0.30/0.40	0.035/0.06	0.030	1.20/1.50	—	—	0.10/0.20	—
BFM Spezial	0.45/0.50	1.40/1.60	0.30/0.40	0.035/0.06	0.030	1.20/1.50	—	—	0.20	—

Tool Steels

WC128	0.65/0.70	0.15/0.30	1.70/1.90	0.04/0.07	0.04	—	—	—	—	—
WC2448	1.20/1.30	0.30	11.00/12.00	0.08	0.04	—	—	—	—	—
EF1514	0.70/0.80	0.20/0.40	0.50/0.70	0.025	0.02	1.00/1.20	0.50	—	—	—
EFS Spezial S	0.45/0.50	0.20/0.40	0.50/0.80	0.035/0.06	0.030	1.20/1.50	1.10/1.40	—	—	—
EFWP	0.50/0.55	0.15/0.30	0.30/0.60	0.025	0.02	0.90/1.20	3.00/3.50	—	—	—
WF33	0.12/0.18	0.40	0.40/0.60	0.035	0.035	0.60/0.80	—	—	—	—
F168	0.82/0.87	0.20/0.40	0.20/0.35	0.03/0.05	0.03	1.70/1.90	—	—	—	—
F168	0.82/0.87	0.20/0.40	0.20/0.35	0.025	0.02	1.70/1.90	—	—	—	—
F182/DF35	0.85/0.90	0.30/0.50	0.50/0.70	0.03/0.05	0.03	0.35/0.45	—	—	—	—
F193	0.90/1.00	0.20/0.35	0.20/0.35	0.03/0.05	0.03	0.70/0.90	—	—	—	—
F193	0.90/1.00	0.20/0.35	0.20/0.35	0.025	0.02	0.70/0.90	—	—	—	—
WF202	1.05/1.15	0.25/0.40	0.25/0.45	0.03/0.05	0.03	0.30/0.50	—	—	—	—
WF204	1.00/1.10	0.25/0.40	0.25/0.45	0.03/0.05	0.03	0.80/1.00	—	—	—	—
WF206	0.95/1.05	0.25/0.40	0.40/0.60	0.03/0.05	0.03	1.25/1.50	—	—	—	—
F206G	0.95/1.05	0.25/0.40	0.40/0.60	0.025	0.02	1.25/1.50	—	—	—	—
F261	1.26/1.32	0.15/0.30	0.15/0.30	0.03/0.05	0.03	0.20/0.30	—	—	—	—
F261P	1.26/1.32	0.15/0.30	0.15/0.30	0.025	0.025	0.20/0.30	—	—	—	—
F283	1.35/1.45	0.25/0.35	0.25/0.40	0.03/0.05	0.03	0.80/0.80	—	—	—	—
F306	1.40/1.50	0.15/0.30	0.30/0.60	0.03/0.05	0.03	1.30/1.50	—	—	—	—
F306G	1.40/1.50	0.15/0.30	0.30/0.60	0.025	0.02	1.30/1.50	—	—	—	—
F3014 LCS	1.40/1.50	1.40/1.60	0.30/0.50	0.025	0.03	3.40/3.60	—	—	—	—
F4048	2.00/2.20	0.20/0.40	0.20/0.40	0.025	0.03	11.00/12.00	—	—	—	—
WFC27	0.14/0.19	0.40	1.00/1.30	0.035	0.035	0.80/1.10	—	—	—	—

Tool Steels

BRAND	C	Si	Mn	P	S	Cr	Ni	Mo	V	Ti	
WFC29	0.17/0.22	0.40	1.10/1.40	0.035	0.035	1.00/1.30	—	—	—	—	—
WFC31	0.20/0.25	0.40	1.30/1.60	0.035	0.035	1.20/1.50	—	—	—	—	—
WFF24	0.15	1.00/1.30	0.20/0.40	0.025	0.02	23.00/25.00	—	—	—	—	Al 1.50/2.00
WFM48	0.28/0.33	0.40	0.50/0.70	0.03	0.03	2.20/2.50	—	—	—	0.15/0.20	—
WN48	0.28/0.33	0.40	0.50/0.70	0.025	0.02	2.20/2.50	—	—	—	0.15/0.20	—
FM881	0.34/0.39	0.40	0.45/0.60	0.035	0.03	1.60/1.90	—	—	—	0.10/0.15	—
WFM961	0.43/0.48	0.40	0.50/0.70	0.03	0.03	1.30/1.50	—	—	—	0.15/0.20	—
WFM1041	0.47/0.55	0.40	0.80/1.00	0.03	0.03	1.00/1.20	—	—	—	0.10/0.18	—
WFM1141	0.55/0.62	0.40	0.90/1.10	0.03	0.03	1.00/1.20	—	—	—	0.10/0.18	—
FM1251	0.60/0.68	0.70/1.00	0.70/1.00	0.03	0.03/0.05	1.10/1.30	—	—	—	0.10/0.18	—
FM2432	1.15/1.25	0.20/0.35	0.20/0.40	0.03	0.03/0.05	0.60/0.80	—	—	—	0.10/0.15	—
WFP12	0.30/0.35	0.40	0.50/0.70	0.025	0.02	1.30/1.50	—	—	—	—	1.00/1.20
HGS	0.55/0.60	0.20/0.40	0.50/0.70	0.03	0.03	0.60/0.80	1.50/1.80	0.15/0.20	—	—	—
HGS Extra, REZ Extra	0.50/0.55	0.20/0.40	0.50/0.70	0.03	0.03	0.60/0.80	—	0.40/0.50	—	—	—
HGS Spezial	0.34/0.39	0.20/0.40	0.50/0.70	0.03	0.03	0.60/0.80	—	0.15/0.20	—	—	—
HM4G	0.90/1.00	0.20/0.40	0.25/0.40	0.025	0.025	0.35/0.50	—	—	—	—	—
M202	0.90/1.00	0.20/0.30	0.35/0.45	0.025	0.02	—	—	—	0.25/0.30	—	W
NFKC	1.35/1.45	0.15/0.30	0.25/0.35	0.025	0.02	0.40/0.50	—	—	0.20/0.30	—	3.00/3.50
PFM	0.95/1.05	0.15/0.30	0.15/0.30	0.03/0.05	0.03	0.20/0.30	—	—	0.10/0.15	—	—
Amino 3	0.38/0.43	0.30/0.60	0.20/0.40	0.025	0.02	12.50/13.50	0.60	—	—	—	—
WA5M	0.17/0.22	0.60	0.40	0.025	0.02	12.50/13.50	—	—	—	—	—
WA100	0.43/0.48	2.30/2.80	1.00/1.40	0.025	0.02	17.50/18.50	8.50/9.50	—	—	0.90/1.20	—
WA342	0.40/0.45	0.20/0.40	0.80/1.00	0.035	0.035	1.70/2.00	—	0.15/0.20	—	—	—
WA402 Extra Spez.	0.45/0.50	0.20/0.40	0.65/0.85	0.035	0.035	1.30/1.50	—	0.55/0.65	0.25/0.30	—	—
WA594	0.26/0.32	0.80/1.00	0.20/0.40	0.03	0.03/0.05	2.20/2.50	—	—	0.30/0.40	—	W
WA904	0.25/0.30	0.20/0.40	0.30/0.50	0.025	0.02	1.00/1.20	—	—	0.15/0.20	—	3.50/4.00
WA904 Extra	0.30/0.35	0.15/0.35	0.20/0.40	0.025	0.02	2.20/2.50	—	—	0.60/0.65	—	4.00/4.50
WA Universal	0.40/0.45	0.50/0.70	0.30/0.50	0.025	0.02	1.20/1.50	—	0.40/0.50	0.75/0.85	—	0.40/0.50

Electrode Steels

Welding Rods—Carbon Steels

	C	Si	Mn	P	S	Cr	Ni	Mo	V	Tij
Zeus EV37T	0.12	Sp.	0.30/0.50	0.040	0.035	—	—	—	—	0.05
Zeus GV37T	0.12	0.05	0.50	0.040	0.035	—	—	—	—	0.05
Zeus EV42 / Zeus EV Universal / Zeus EV Atlantik.	0.16	0.05	0.50/0.70	0.040	0.035	—	—	—	—	0.05
Zeus GV42	0.15/0.25	0.08/0.15	0.60/0.80	0.030	0.030	—	—	—	—	—
Zeus EV Max	0.10/0.14	0.05	0.50/0.70	0.030	0.030	—	—	—	—	0.05

Welding Rods—Alloy Steels

BRAND	C	Si	Mn	P	S	Cr	Ni	Mo	V	Ti	
Zeus-EV52 / Zeus GV52 / Zeus EV70 / Zeus EV Optimum A + B / ElliraschweiBdr. I	0.10/0.15	0.03/0.10	1.40/1.60	0.03	0.03	—	—	—	—	—	
Zeus EV60 / ElliraschweiBdr. II	0.11/0.16	0.18/0.28	3.10/3.40	0.03	0.03	—	—	—	—	—	N²
Zeus EV leg. CF 100 Spezial	0.08	0.30/0.60	17.0/18.0	0.025	0.02	14.50/15.50	—	—	—	—	0.28/0.33
Zeus EV leg. Cromadur	0.12	0.30/0.60	17.50/18.50	0.025	0.02	11.50/12.50	—	—	0.60/0.70	—	0.18/0.23
Zeus EV leg. FFT. 6	0.12	2.40/2.70	0.20/0.40	0.025	0.02	5.70/6.20	—	—	—	0.50/0.70	—
Zeus EV leg. FF13	0.15	2.40/2.70	0.20/0.40	0.025	0.02	12.50/13.50	—	—	—	—	Al
Zeus EV leg. FF 30	0.10/0.15	1.00/1.50	0.20/0.40	0.025	0.02	28.00/30.00	—	—	—	—	0.90/1.10
Zeus EV leg. FM 363	0.10/0.17	0.40	0.25/0.40	0.03	0.03	1.20/1.40	—	—	0.25/0.35	—	—
Zeus EV leg. FM 2121	0.12	0.15/0.30	0.30/0.50	0.025	0.02	3.40/3.60	—	—	0.10	—	—
Zeus EV leg. FKM 4653	0.18/0.23	0.30/0.50	0.40/0.60	0.035	0.035	1.30/1.50	0.30	0.35/0.40	0.35/0.45	—	—
Zeus EV Zeus GV leg. NCT 5	0.10/0.15	1.20/1.50	0.40/0.60	0.025	0.02	20.00/22.00	9.00/10.00	—	—	0.10	—
Zeus EV Zeus GV leg. NCT 3 / NCT 3/113	0.15	0.90/1.20	2.00/2.30	0.025	0.02	23.00/25.00	19.00/20.00	—	—	0.10	—
Zeus EV Zeus GV leg. V2A	0.07	0.30/0.60	0.20/0.40	0.025	0.02	17.50/18.50	8.50/9.50	—	—	Ta+Cb	
Zeus EV leg. V2AX	0.07	1.30/1.60	1.20/1.40	0.025	0.02	18.50/19.50	8.50/9.50	—	—	1.80/2.00	
Zeus EV Zeus GV leg. V4A	0.07	0.30/0.60	0.20/0.40	0.025	0.02	17.00/18.00	9.50/10.50	1.90/2.20	Ti 0.10	—	—
Zeus EV leg. V4AB Supra	0.10	2.20/2.50	0.20/0.40	0.025	0.02	17.50/18.50	9.00/10.00	2.20	—	—	—
Zeus EV leg. V10A	0.18/0.28	1.10/1.40	5.50/6.50	0.025	0.02	19.00/20.00	7.50/8.50	—	—	—	—
Zeus EV leg. V14A	0.07	0.30/0.60	0.20/0.40	0.025	0.02	16.50/17.50	12.50/13.50	4.50/5.00	0.10	— Cu	—
Zeus EV leg. V46A Extra	0.07	0.60	0.40	0.025	0.02	17.00/18.00	9.50/10.50	1.90/2.20	—	2.80/3.10	—
Zeus EV leg. HGS	0.55/0.60	0.20/0.40	0.50/0.70	0.03	0.03	0.60/0.80	1.50/1.80	0.15/0.20	—	—	—

terials of a similar nature, these materials consisting of high speed alloy and carbon tool steels, special steels such as magnet steels and valve steels, heat and corrosion resisting steels and structural alloy steels of the SAE type. Both Krupp and Edelstahle as well as Poldi produced sintered carbides which are covered in a separate report by Prof. Gregory Comstock.*

See "German Cemented Carbide Industry," by Prof. Gregory Comstock, THE IRON AGE, Aug. 30, 1945, p. 36.

A study of the compositions manufactured in 1939 as compared to those being manufactured in 1945 reveals some changes as a result of lack of alloying metals. A direct comparison exists in the list of tool steels as made by Rochling, one list showing the compositions manufactured in 1939 and the other list showing the composition being manufactured in the fall and winter of 1944. The study of the compositions reveals that there was a decided preference in 1939 for high speed steels containing about 13 pct tungsten, about 4 pct chromium and high vanadium content, the vanadium content being from 1.5 pct to as high as 5 pct. The carbon was likewise proportionately increased with the vanadium content, in one instance being as high as 1.50 pct and a cobalt content of 4.75 pct. Many of the high speed steels contained cobalt from as low as about 2 pct to as high as 15 pct. As a result of the lack of alloying metals a high speed steel was developed containing from 0.90 pct to 1.00 pct carbon, about 4 pct chromium and a tungsten molybdenum and vanadium content each within the limits from 2 pct to 3 pct.

All of the men interviewed who manufactured this steel were very enthusiastic regarding its performance. Dr. Houdremont stated that it averaged about 20 pct better

Electrode Steels

Electrodes for Hard Surfacing

BRAND	C	Si	Mn	P	S	Cr	Ni				
Zeus EA Zeus GA Mangan	1.05 — 1.25	0.30	13.50 — 14.50	0.08	0.04	—	—	—	—	—	—
Zeus EA leg. V13F	0.12	0.30 — 0.60	0.30 — 0.40	0.025	0.20	12.50 — 13.50	—	—	—	—	0.20
Zeus EA leg. V17F	0.10	0.60	0.40	0.025	0.02	17.00 — 18.00	0.20	—	—	—	Ti
Zeus EA Zeus GA 150	0.17 — 0.23	0.30 — 0.40	0.90 — 1.10	0.03	0.03	—	—	—	—	—	0.10 — 0.30
Zeus EA Zeus GA 250	0.24 — 0.29	0.30 — 0.40	1.50 — 1.70	0.03	0.03	—	—	—	—	—	0.10 — 0.30
Zeus GA leg. F20S	1.50 — 1.70	0.80 — 1.00	0.10 — 0.30	0.025	0.02	19.50 — 20.50	—	—	—	—	—
Zeus EA leg. F20SH	2.40 — 2.60	0.80 — 1.00	0.10 — 0.30	0.025	0.02	19.50 — 20.50	—	—	—	—	—
Zeus GA leg. F28S	1.50 — 1.70	0.80 — 1.00	0.50 — 0.60	0.025	0.02	27.50 — 28.50	—	—	—	—	—
Zeus EA leg. F28SH	2.00 — 2.20	0.80 — 1.00	0.50 — 0.60	0.025	0.02	27.50 — 28.50	—	—	—	—	—
Diaweld	4.20 — 4.40	1.80	5.00 — 6.00	—	—	30.00	—	—	—	—	—
Zeus EA Zeus GA 350	0.43 — 0.48	0.30 — 0.40	2.00 — 2.20	0.03	0.03	0.90 — 1.20	—	—	—	—	0.10 — 0.30
Zeus EA Zeus GA 500	0.85 — 0.90	0.30 — 0.40	2.20 — 2.20	0.03	0.03	1.30 — 1.30	—	—	—	—	0.10 — 0.30
Zeus EA Zeus GA Percit Extra	1.20 — 1.40	2.00 — 3.00	0.20 — 0.60	0.025	0.02	26.00 — 28.00	— Co	—	Co 57.00 — 63.00	W 3.80 — 4.80	
Zeus EA Zeus GA Percit Spezial	1.40 — 1.60	1.30 — 1.60	0.20 — 0.60	0.025	0.02	25.00 — 30.00	30.00 — 35.00	— V	—	— 4.00 — 4.50	
Zeus EA leg. NFKC	1.35 — 1.45	0.15 — 0.30	0.25 — 0.35	0.025	0.02	0.40 — 0.50	— Mo	0.20 — 0.30	— Ti	— 3.00 — 3.50	
Zeus EA Zeus GA leg. KFM	0.92 — 0.98	0.30	0.30	0.025	0.02	3.50 — 4.00	2.20 — 2.50	2.70 — 3.00	0.10 — 0.15	1.20 — 1.50	
Zeus EA Zeus GA leg. DFMV 5	1.30 — 1.40	0.30	0.30	0.025	0.02	4.00 — 4.50	—	4.20 — 4.50	—	10.00 — 11.00	

Works—Leipzig Rochlingstahl G.M.B.H., Leipzig W 35

High Speed, and Tool Steels manufactured before and during the war by the Rochlingstahl Works at Leipzig

Steels Before the War

High Speed Steels

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co
Gigant 66	1.40 — 1.50	0.20 — 0.30	0.20 — 0.30	4.00 — 4.50	—	12.00 — 13.00	0.40 — 0.70	4.20 — 5.00	4.20 — 5.00
Gigant Uno	0.72 — 0.80	0.20 — 0.30	0.30 — 0.30	4.50 — 4.50	—	13.00 — 13.00	0.70 — 0.70	1.50 — 1.80	5.00 — 5.00
Gigant 33	0.85 — 0.95	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	13.00 — 13.00	0.70 — 0.70	2.00 — 2.30	2.30 — 2.60
Gigant N	0.72 — 0.80	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	13.00 — 13.00	0.70 — 0.70	1.50 — 1.70	2.30 — 2.60
Gigant	1.05 — 1.15	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	11.00 — 12.00	0.40 — 0.70	2.30 — 2.60	— —
Kosmos	0.82 — 0.90	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	11.50 — 12.50	0.60 — 0.80	2.35 — 2.65	— —
RSV	0.72 — 0.85	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	12.50 — 12.50	0.80 — 0.80	1.80 — 2.00	— —
RSZ Special	0.75 — 0.83	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	10.50 — 11.50	0.60 — 0.80	1.30 — 1.50	— —
RSZ	0.72 — 0.80	0.30 — 0.30	0.30 — 0.30	4.50 — 4.50	—	11.50 — 11.30	0.40 — 0.60	0.80 — 1.00	— —

Carbon Steels

BRAND	C	Mn	Si	
RT 6	0.60	0.22	0.12	—
RT 7	0.69 — 0.70 — 0.79	0.35 — 0.35 — 0.35	0.25 — 0.25 — 0.25	— — —
RT 8	0.80 — 0.89	0.35 — 0.35	0.25 — 0.25	— —
RT 9	0.90 — 0.99	0.35 — 0.35	0.25 — 0.25	— —
RT 10	1.00 — 1.09	0.35 — 0.35	0.25 — 0.25	— —
RT 11	1.10 — 1.19	0.35 — 0.35	0.25 — 0.25	— —
RT 12	1.20 — 1.34	0.35 — 0.35	0.25 — 0.25	— —
RT 14	1.35 — 1.44	0.35 — 0.35	0.25 — 0.25	— V
RV 1	0.70 — 0.77	0.22 — 0.30	0.08 — 0.15	0.05 — 0.10
RB 7	0.77	0.30	0.15	—
RB 12	1.11	0.30	0.15	—

Tool Steels for Hot Work

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co	Cu
RWS	0.33	0.20	0.25	3.25	—	2.60	—	0.25	—	—
	0.36	0.30	0.35	3.45	—	3.00	—	0.35	—	—
WNC	0.35	0.20	0.30	1.30	3.20	5.00	—	—	—	—
	0.40	0.30	0.40	1.50	3.60	5.50	—	—	—	—
RCW 2	0.24	0.20	0.20	2.20	—	9.00	—	—	—	—
	0.30	0.30	0.30	2.80	—	10.00	—	—	—	—
Pulsus	0.35	0.20	0.50	4.70	1.40	—	0.45	0.10	—	—
	0.42	0.30	0.75	5.00	1.60	—	0.65	0.20	—	—
SGM 2	0.31	0.30	0.20	2.20	—	7.50	—	0.50	2.50	—
	0.35	0.30	0.30	2.80	—	8.50	—	0.50	2.50	—
SGM 4	0.24	0.30	0.30	1.30	—	5.00	0.50	—	4.50	1.20
	0.30	0.30	0.30	1.60	—	5.50	0.70	—	5.00	1.50
RWS 2	0.24	0.30	0.40	1.10	—	4.00	—	—	—	—
	0.28	0.30	0.50	1.20	—	4.50	—	—	—	—
RWS 4	0.32	0.40	0.80	1.30	—	4.00	0.40	—	—	—
	0.38	0.50	1.00	1.60	—	4.50	0.60	—	—	—
CeOT	0.38	0.80	0.30	1.60	—	—	0.70	0.15	—	—
	0.45	1.00	0.50	1.80	—	—	0.90	0.25	—	—
NGS	0.25	0.80	0.30	1.50	—	—	0.80	0.40	—	—
	0.33	1.00	0.50	1.80	—	—	1.00	0.60	—	—
RCNW	0.33	0.30	0.20	1.30	4.00	0.90	—	—	—	—
	0.38	0.45	0.30	1.50	4.50	1.15	—	—	—	—
MFR	0.42	0.80	0.20	0.80	—	—	0.25	—	—	—
	0.50	1.10	0.40	1.10	—	—	0.40	—	—	—
PG 3	0.27	0.30	0.20	2.90	—	—	2.30	0.40	—	—
Stentor	0.53	0.50	0.15	0.60	1.30	—	0.20	—	—	—
	0.60	0.65	0.25	0.75	1.70	—	0.30	—	—	—
RGS 4	0.53	0.50	0.25	0.65	1.75	—	0.80	—	—	—
	0.60	0.60	0.35	0.80	2.00	—	0.80	—	—	—
RWM	0.50	0.45	0.40	—	—	—	—	—	—	—
	0.58	0.55	0.50	—	—	—	—	—	—	—
WWS	0.55	0.90	1.00	—	—	—	—	—	—	—
	0.65	1.00	1.30	—	—	—	—	—	—	—
PWD	0.23	0.20	0.20	0.35	4.00	—	1.15	—	—	—
	0.28	0.30	0.30	0.50	4.50	—	1.25	—	—	—
PWDN	0.25	0.30	0.30	0.60	4.50	3.80	0.65	—	—	—
	0.32	0.30	0.30	0.80	4.50	4.30	0.85	—	—	—

Tool Steels for Cold Work

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co
RCC	1.80	0.20	0.30	12.00	—	—	—	—	—
	2.10	0.30	0.40	13.00	—	—	—	—	—
RUS	0.85	1.70	0.20	0.15	—	—	—	0.10	—
	0.95	1.90	0.30	0.25	—	—	—	0.20	—
RUS 2	1.00	0.30	1.20	0.90	—	—	—	—	—
	1.10	0.40	1.40	1.10	—	—	—	—	—
RUS 4	0.95	0.40	0.20	1.40	—	0.90	—	—	—
	1.10	0.60	0.30	1.60	—	1.10	—	—	—
T 76	1.45	0.20	0.20	0.60	—	[7.0 max.]	0.30	0.30	—
	1.55	0.30	0.30	0.80	—	7.80	—	0.50	—
RTW 3 Special	1.30	0.20	0.20	0.60	—	4.60	—	—	—
	1.40	0.30	0.30	0.80	—	5.00	—	—	—
RTW 1	1.15	0.20	0.15	0.10	—	1.10	—	—	—
	1.25	0.30	0.25	0.20	—	1.30	—	—	—
RTW 2	0.33	0.30	0.90	1.00	—	2.60	—	—	—
	0.40	0.40	1.10	1.20	—	3.00	—	—	—
Robust M	p.40	0.40	1.10	1.20	—	2.25	—	—	—
	0.46	0.40	1.10	1.20	—	2.50	—	—	—
RTWK	0.60	0.20	0.20	1.00	—	2.20	—	0.10	—
	0.65	0.40	0.30	1.50	—	2.50	—	0.20	—
ZK	1.50	0.20	0.20	1.80	—	—	—	—	—
	1.60	0.30	0.30	2.00	—	—	—	—	—
RTC 20	0.88	0.25	0.30	2.00	—	—	—	—	—
	0.95	0.35	0.30	2.00	—	—	—	—	—
RTK 10	1.00	0.35	0.30	1.00	—	—	—	—	—
	1.10	0.35	0.30	1.25	—	—	—	—	—
RTC 14	0.93	0.25	0.30	0.30	—	—	—	—	—
	1.10	0.40	0.30	1.60	—	—	—	—	—
RT 14 Cr	1.35	0.20	0.15	0.40	—	—	—	—	—
	1.45	0.30	0.25	0.60	—	—	—	—	—

Tool Steels for Cold Work (Cont'd)

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co
RT 11 Cr	1.00	0.30	0.25	0.20	—	—	—	—	—
	1.10	0.30	0.25	0.40	—	—	—	—	—
RT 7 Cr	0.70	0.20	0.25	0.45	—	—	—	—	—
	0.79	0.30	0.25	0.55	—	—	—	—	—
Kubax	1.20	0.35	0.15	0.16	—	—	—	0.15	—
	1.30	0.45	0.25	0.20	—	—	—	0.25	—
RKMV	0.95	0.40	0.15	—	—	—	—	Spuren	—
	1.00	0.50	0.25	—	—	—	—	Spuren	—
SKSV	0.65	0.23	max.	—	—	0.50	—	0.10	—
	0.73	0.33	0.15	—	—	0.60	—	0.15	—
RTC 14 Mo	1.10	0.30	0.15	1.15	—	—	0.20	—	—
	1.20	0.40	0.30	1.30	—	—	0.30	—	—
D Special	0.96	0.35	0.30	1.90	—	—	—	—	—
	1.00	0.45	0.40	2.10	—	—	—	—	—
RAB w	0.42	0.40	0.20	1.30	3.40	—	—	—	—
	0.50	0.50	0.30	1.50	3.65	—	—	—	—
RAB 1	0.35	0.40	0.20	1.30	4.20	—	—	—	—
	0.38	0.50	0.30	1.50	4.60	—	—	—	—
Ordix	0.60	0.35	1.20	—	—	—	—	—	—
	0.70	0.50	1.50	—	—	—	—	—	—

Steels During War, 1944

High Speed Steels

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co
Gigant 11	0.92	0.20	0.20	3.50	—	1.20	2.20	2.20	—
	0.98	0.35	0.35	4.00	—	1.50	2.50	2.50	—
Gigant 22	0.78	0.20	0.20	3.50	—	7.30	—	1.80	—
	0.85	0.35	0.35	4.00	—	8.00	—	2.00	—
Gigant 44	1.30	0.35	0.35	4.00	—	9.00	—	3.50	—
	1.40	0.35	0.35	4.50	—	10.00	—	4.00	—
Gigant 5	0.87	0.35	0.35	3.50	—	9.00	—	1.90	2.50
	0.95	0.35	0.35	4.00	—	10.00	—	2.20	3.00

Tool Steels for Hot Work

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co
WWS	0.50	0.80	0.80	—	—	—	—	—	—
	0.57	1.00	1.00	—	—	—	—	—	—
Robust 35	0.32	0.30	1.20	1.20	—	—	—	0.05	—
	0.40	0.50	1.50	1.50	—	—	—	0.10	—
Faktum	0.26	0.40	0.15	2.20	—	—	—	0.13	—
	0.34	0.60	0.25	2.50	—	—	—	0.18	—
RAN	0.40	0.50	0.20	1.20	1.10	—	—	—	—
	0.50	0.80	0.40	1.50	1.40	—	—	—	—
RWA	0.25	0.20	0.15	2.20	—	4.00	—	0.50	—
	0.35	0.40	0.25	2.50	—	4.50	—	0.60	—
MFR	0.35	1.10	0.15	1.70	—	—	0.05	0.10	—
	0.45	1.50	0.25	2.00	—	—	0.10	0.15	—
Stentor	0.50	0.50	0.15	0.60	1.50	—	0.10	0.10	—
	0.60	0.80	0.25	0.80	1.80	—	0.15	0.18	—
PWD 13	0.22	0.20	0.30	0.60	1.20	—	0.20	0.15	—
	0.30	0.40	0.50	0.90	1.50	—	0.40	0.20	—
NGSA	0.40	0.30	0.50	1.20	—	0.40	0.40	0.75	—
	0.50	0.50	0.70	1.50	—	0.50	0.50	0.85	—
RGS 4	0.50	0.50	0.15	1.00	1.50	—	0.30	0.15	—
	0.60	0.80	0.25	1.20	1.80	—	0.40	0.20	—
PWD 6	0.24	0.20	0.30	0.60	2.20	—	0.50	0.25	—
	0.32	0.40	0.50	0.90	2.50	—	0.70	0.32	—
CeOT	0.40	0.55	0.15	1.30	—	—	0.55	0.25	—
	0.50	0.85	0.25	1.50	—	—	0.70	0.32	—

than a standard 18 pct tungsten high speed steel for general applications. All manufacturers did admit that it was very sensitive to grain growth and must be heat treated within narrow temperature limits to obtain good performance. The usual recommended quenching temperature was 1240° C. with a tempering temperature of 545° C., double tempering being standard practice with this steel as with all other high speed steels. It is interesting to note, however, that Krupp manufactured this steel with a Ti content of from 0.05 pct to 0.10 pct. In questioning other manufacturers of this steel as to whether they used any other alloying elements or deoxidizers other than those already stated they invariably said no, and it appeared that Krupp only used Ti. Dr. Houdremont stated definitely that if Ti was not used the steel was more susceptible to grain growth. A number of tool

Tool Steels for Cold Work

BRAND	C	Mn	Si	Cr	Ni	W	Mo	V	Co
R LB	0.11	0.25	0.20	—	—	—	—	—	—
	0.18	0.40	0.30	—	—	—	—	—	—
RB 7	0.68	0.20	0.10	—	—	—	—	—	—
	0.75	0.35	0.20	—	—	—	—	—	—
RT 7	0.70	0.22	0.08	—	—	—	—	—	—
	0.80	0.32	0.15	—	—	—	—	—	—
RR 7	0.70	0.60	0.25	—	—	—	—	—	—
	0.80	0.80	0.40	—	—	—	—	—	—
BS 2	0.75	0.50	0.25	—	—	—	—	—	—
	0.83	0.70	0.40	—	—	—	—	—	—
RT 11	0.05	0.15	0.15	—	—	—	—	—	—
	1.15	0.25	0.25	—	—	—	—	—	—
S	0.25	0.20	0.10	—	—	—	—	—	—
	1.35	0.35	0.20	—	—	—	—	—	—
Ordix	0.65	0.60	1.50	—	—	—	—	—	—
	0.75	0.80	1.80	—	—	—	—	—	—
RFFw	0.42	0.80	0.80	—	—	—	—	—	—
	0.50	1.00	1.00	—	—	—	—	—	—
RUS	0.85	1.80	0.15	—	—	—	—	0.08	—
	0.95	2.00	0.25	—	—	—	—	0.15	—
ES	1.30	0.20	0.25	0.50	—	—	—	—	—
	1.50	0.35	0.40	0.80	—	—	—	—	—
RTS	1.10	0.20	0.15	0.50	—	—	—	0.07	—
	1.25	0.40	0.25	0.80	—	—	—	0.12	—
RTC 14	0.95	0.60	0.40	0.75	—	—	—	—	—
	1.05	0.80	0.60	0.95	—	—	—	—	—
RSH	1.00	0.25	0.15	0.80	—	—	—	—	—
	1.10	0.40	0.25	1.00	—	—	—	—	—
Ordix Special	0.55	0.80	0.15	0.90	—	—	—	0.07	—
	0.62	1.10	0.25	1.20	—	—	—	0.12	—
D Special	1.20	0.60	1.05	1.10	—	—	—	—	—
	1.30	0.80	0.25	1.30	—	—	—	—	—
Robust 40	0.40	0.40	1.20	1.20	—	—	—	0.05	—
	0.50	0.60	1.50	1.50	—	—	—	1.10	—
ZK	1.40	0.30	1.15	1.30	—	—	—	0.08	—
	1.50	0.60	0.25	1.50	—	—	—	0.15	—
RTC 20	0.80	0.25	0.10	1.60	—	—	—	—	—
	0.90	0.40	0.30	1.90	—	—	—	—	—
RCC	2.00	0.20	0.20	11.00	—	—	—	—	—
	2.25	0.40	0.40	12.00	—	—	—	—	—
RCCw	1.55	0.40	0.40	12.00	—	—	—	0.07	—
	1.75	0.40	0.40	12.00	—	—	—	0.12	—
RABw	0.45	0.30	0.15	0.90	3.00	—	—	—	—
	0.55	0.60	0.30	1.20	3.50	—	—	—	—

Steels of the Bohler Works

Available 1940

High Speed Steels

BRAND	C	W	V	Mo	Cr	Co
CC Special	0.75	18.00	1.60	0.80	4.00	19.00
CC	0.80	18.00	1.60	1.00	4.20	9.00
Super Rapid Extra 500	0.85	18.50	2.00	0.50	4.00	5.00
Super Rapid Extra 214	0.70	19.00	1.70	—	4.30	2.40
Super Rapid Extra HV	0.90	14.50	2.00	1.15	4.50	—
Super Rapid Extra	0.65	18.50	1.30	—	4.00	—
Super Rapid	0.65	15.50	0.60	—	3.75	—

Special Tool Steels

BRAND	C	Si	Mn	Cr	W	V
RM Special Sehr Hart	1.50	0.25	0.25	0.65	7.50	0.40
Special Sehr Hart	1.40	0.25	0.25	0.65	4.75	0.25
Special Sehr Hart	1.30	0.25	0.25	0.65	4.75	0.25

Alloy Tool Steels

BRANDS	C	Si	Cr	W	V	Mn
KP	1.30	0.20	—	4.75	—	0.30
KL	0.50	0.85	1.60	1.90	0.10	0.45
MY Extra	0.40	0.90	1.00	1.85	—	0.35
MY A	0.40	1.50	1.35	—	0.10	0.30
Amutit	1.00	0.25	1.10	1.50	—	0.90
MST	0.80	0.25	—	—	0.10	1.90
MG Extra	1.00	0.20	0.55	—	—	1.10
TWW	1.25	0.25	0.85	1.65	—	0.30
T W	1.15	0.25	—	0.90	—	0.30
SW	1.00	0.20	—	0.90	—	0.30
TWV	1.20	0.20	—	1.20	—	0.25
Special K	2.00	0.70	12.00	—	—	0.30
Special KN	2.00	0.35	12.00	—	—	0.30
K Extra	0.80	0.25	1.50	—	—	0.30
K 100 S	1.10	0.30	1.20	—	—	0.35
K 100/I	1.20	0.25	0.80	—	—	0.40
Extra Hart	1.40	—	0.50	—	1.10	0.30

Carbon Tool Steels

BRAND	C	Mn	Si	V
Extra Mittel-Hart	1.25	0.20	0.25	—
Extra-Zahhart	1.10	0.20	0.20	—
Extrasah	0.85	0.20	0.25	—
Extra H	1.00	0.25	0.25	0.10
Hart	1.40	0.30	0.25	—
Mittel-Hart	1.00	0.30	0.25	—
Ash	0.85	0.30	0.25	—
Weich	0.65	0.30	0.25	—

Tool Steels for Cold Works

BRAND	C	Si	Mn	Cr	W	V	Mo	Ni
NBS	0.50	0.25	0.25	1.00	—	—	—	3.20
NBSN	0.50	0.25	0.25	0.70	—	—	0.30	1.50
TWV	1.20	0.20	—	—	1.20	0.10	—	—
WON	0.80	0.30	0.35	—	—	0.35	—	—

Tool Steels for Hot Works

BRAND	C	Si	Mn	Cr	W	V	Co	Mo	Ni
WPZ	0.30	0.30	0.30	2.25	9.00	0.35	2.25	—	—
WKZ	0.30	0.30	0.40	2.25	8.50	0.40	—	—	—
WPD	0.25	0.30	0.35	1.85	0.90	—	—	2.85	2.50
US Special	0.40	0.30	0.30	1.55	—	0.30	—	0.60	—
NW	0.40	0.30	0.50	1.25	—	—	—	—	4.40
GNM	0.50	0.30	0.50	0.70	—	—	—	0.30	1.50
GSI	0.50	0.30	0.90	0.70	—	—	—	—	—
WB	0.50	0.50	0.90	—	—	—	—	—	—

High Speed Steels

Available 1944

BRAND	C	Si	Mn	W	Cr	Mo	V	Co
Super Rapid, Extra 214 A	0.70	0.30	0.30	9.50	3.70	—	2.80	2.80
Extra Rapid 300 A	1.20	0.30	0.30	10.50	4.30	—	3.80	—
Super Rapid, Extra HVA	0.90	0.30	0.30	9.50	3.80	—	2.50	—
Super Rapid, Extra A	0.65	0.30	0.30	8.50	3.80	—	1.80	—
MO Rapid Extra 3 A	1.00	0.30	0.30	1.35	3.80	2.35	2.35	—

Tool Steels

BRAND	C	Si	Mn	W	Cr	Mo	V	Co	Ni
Special sehr-hart A	1.40	0.25	0.25	3.25	0.65	—	0.25	—	—
SSC	1.10	0.20	0.30	—	0.70	—	0.10	—	—
FM Extra	1.50	0.20	0.40	—	1.40	—	0.10	—	—
SC Extra	1.25	1.15	0.30	—	1.20	—	—	—	—
CNW	0.45	0.25	0.30	—	1.35	—	—	—	1.65
MSI	0.60	0.95	0.95	—	—	—	—	—	—
GMNE	0.55	0.30	0.30	—	0.70	0.50	—	—	1.70
WKV	0.45	0.60	0.25	0.50	1.35	0.50	0.90	—	—
WKZ 50	0.30	0.60	0.25	4.35	2.35	—	0.65	—	—
WM	0.30	0.30	0.30	3.85	1.05	—	0.20	—	—
WM 2	0.35	0.90	0.30	1.85	0.05	—	0.20	—	—
GMCA	0.40	0.25	1.35	—	1.85	0.20	—	—	—
US 25	0.30	0.30	0.30	—	2.35	—	0.25	—	—
MYD	0.35	1.50	0.30	—	1.35	—	0.10	—	—
SCV	0.60	0.30	1.00	—	1.20	—	0.10	—	—
CSI	0.70	1.30	0.30	—	0.50	—	—	—	—
WKW 6	0.40	0.20	0.30	—	13.50	—	—	—	—
WKW 2	0.20	0.30	0.30	—	13.00	—	—	—	—
ESK	0.15	0.25	0.30	—	0.80	—	—	—	—
KR Special	2.10	0.35	0.30	0.70	12.0	—	—	—	—
KPV	1.45	0.20	0.30	—	—	—	1.20	—	—

makers were visited and in discussing the performance of this special high speed steel, which Dr. Houdremont termed the "Holy Trinity," the users invariably stated that they considered it definitely inferior to the standard types. Mr. Hans Kiehm, director of Franz-Mossman who manufactured twist drills, was quite emphatic in his statements regarding the inferiority of this steel. Molybdenum high speed steels did not seem to find much favor among either the German manufacturers or users, even though several of the companies had obtained licenses to manufacture high speed steel of the Momax type. Little or no molybdenum was produced in Germany or by its satellites, which may explain its small use.

Tool steels for hot work appear to follow rather consistently the American practice, although a much wider range of composition was made for this purpose than that generally made in America. Tungsten was definitely favored as an alloying element for most hot work die steels, and there was a hot work die containing about 4.5 pct tungsten and 1.5 pct chromium made in several carbon ranges from as low as 0.24 pct to as high as about 0.45 pct widely used.

Tool steels for cold work likewise follow the pattern of American practice, but it was noted there was a considerable lack of die steels for cold work of the air hardening variety in which molybdenum was used as the principal contributing element to obtain the air hardening qualities. As a matter of fact it is significant that the entire German industry of tool and special steels did not take advantage of the properties molybdenum imparts to steel as have the American manufacturers. While considerable comment could be made in reference to the compositions manufactured for tools and special applications, a study of the tables will reveal the information much better than will brief comment.

The following tables have been chosen to give both the broad view of all the tool and special steels as manufactured by several makers, while some of the other tables are more condensed to avoid duplication. The first table given is that of Poldi and represents the steels that were manufactured in 1942. It includes high speed steels, many types of tool steels including both for hot and cold work, magnet steels, heat and corrosion resisting steels as well as the complete list of structural alloy steels which in America are often classed as the SAE type. Since the Poldi compositions are the most complete, it is the table most deserving of study. The table of the Rochling steel works contains the tool steels made before the war and during the year 1944. It, therefore, offers a basis of comparison as to how the compositions were affected as the alloys available decreased. The compositions from the Edelstahle steel works are complete, while those of Krupp reflect the many compositions made, including soft as well as alloy steels. The table from Bohler includes tool and special steels only, and included with the Bohler table are the steels as made in 1939 and as made in 1944.

Rapid Spot Test for Nickel in Steel

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and
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o o o

A SPOT test method for nickel in steel has been developed in which the intensity of the spot of red is proportional to the percentage of nickel present in the sample under test. The customary brown stain has been eliminated so that the pink color, which indicates low nickel contents, is plainly recognized, while on the non-nickel types no color is developed.

The improved nickel spot test has been successfully used for the past 18 months in the steel mill and plants of Timken Roller Bearing Co. on numerous types of alloy steels, under a variety of conditions to check scrap and to segregate nickel types on the rolling mill. Trained technical help is not necessary, therefore, it should be of great value in scrap yards and warehouses where this type of employee is usually not available.

The spot test for nickel is, perhaps, the best known of the numerous qualitative methods for the rapid detection of various elements present in steel. A red spot developed on a small piece of absorbent paper indicates the presence of nickel. The nickel spot test has long been used in steel mills to rapidly classify incoming scrap, sort mixed stock, and check numerous types of material on the rolling mills. The steel is tested on the job, it not being necessary to cut and transport samples to the laboratory for analysis.

All of the available spot test methods for nickel indicate the presence of nickel, but the characteristic red spot is partially obliterated by a dark brown stain, particularly where the nickel content is low, as in NE 8600 and 8700 steels. Where the product is mainly alloy types, this condition is frequently quite bothersome.

A series of steels, with known nickel contents, may be used as standards to assist in estimating the percentage of nickel in unknown samples. At Timken Roller Bearing Co. the following types of steel have been selected as standards:

Steel	Nickel, Pct	Color of Spot
SAE 1015	0.15	Colorless
NE 8615	0.55	Faint Pink
4715	1.10	Medium Pink
SAE 4615	1.75	Light Red
SAE 4815	3.50	Dark Red

Materials required:

Acid Solution:

400 Ml. Distilled Water
300 Ml. Nitric Acid (Concentrated)
350 Ml. Phosphoric Acid (85 pct)

Dimethylglyoxime Solution:

1 Gm Dimethylglyoxime
60 Ml. Acetic Acid (Glacial)
30 Ml. Ammonium Hydroxide (28 pct)
10 Gm Ammonium Acetate

A dropping bottle is required for each of the above solutions. A one ounce bottle fitted with a one hole rubber stopper, in which a 1½ in. section of glass tubing, drawn to a fine point is inserted, answers the purpose very well.

A heavy, absorbent filter paper, similar to Whatman No. 41, cut into one inch squares, is used to absorb the drop of acid.

Procedure:

A small area on the steel is cleaned of grease, rust or scale, by filing or grinding, if necessary. A drop of acid solution is placed on the cleaned surface and allowed to attack the steel for about ten sec. The drop is then absorbed in a small strip of filter paper which is allowed to remain on the steel. Two drops of the dimethylglyoxime solution are applied to the spot on the paper, which will turn various shades from a faint pink to a dark red depending on the nickel content, or remain colorless if free from nickel.

Much speed can be attained by placing the bars in a row and testing in batches, that is, putting a drop of acid on the bars, then the filter paper and finally the dimethylglyoxime.

When testing steel that has been pickled, a spot of sufficient area must be cleaned to remove all nickel salts from the surface that might have collected in the pickle bath from a former charge of nickel bearing material. The acid should be placed in the center of the cleaned spot to avoid contact with the uncleaned portion of the piece under test.

The test is non-destructive, and with few exceptions may be applied to finished parts with no harmful results. The spot may be wiped with a damp cloth to remove traces of acid that might cause rust.

This improved spot test method for nickel should find application in a wide variety of metal-working plants in which steels become mixed, and require sorting. It should be particularly valuable at this time in the classification and segregation of battle-field scrap, which is now being returned to the steel mills for remelting into useful peacetime products.

Resinous-Base Plaster Mold Sealant

A RESINOUS - BASE thermosetting plastic, known as "Plaster Sealer," now is being used by Consolidated Vultee Aircraft Corp. for the purpose of sealing the plaster molds used in casting plastics and other materials.

Plaster Sealer can be applied by either spraying or brushing on wet or dry plaster, and it dries in 3 to 4 hr at ordinary room temperatures. It is considered superior to the lacquers heretofore used in sealing plaster molds, because it does not necessitate a heavy coating on casting surfaces where close dimensions and minute details (such as layout and trim lines) must be preserved.

When it is necessary to produce a high-gloss casting in a plaster mold, the basic coating of Plaster Sealer is sanded and recoated. As many as four coatings of the material may be utilized without destroying essential details on the mold surfaces, although two coatings are usually sufficient.

The new plastic is heat-resistant at temperatures of more than 2500 deg F. While it is normally translucent, it can be dyed any color without losing its effectiveness. Plastic Sealer is being produced by Duorite Plastic Industries, 8564 W. Washington Blvd., Culver City, Calif.

Shot And Grit Standards

NEW standards on shot used for peening and cleaning, and for grit employed in blast cleaning, scale removal, and polishing, have been prepared by the Society of Automotive Engineers in conjunction with representatives, suppliers, and users. The systems arranged, together with number series to identify shot and grit are under consideration in the Product Division and the Standard Committee of the SAE, which are expected to approve them without change.

The shot numbers are roughly the size of the pellets in thousandths of an inch. Each number is prefixed with "P." For cleaning shot and grits, different number systems are employed. Each size is defined by the proportion that passes through a screen of stated number and by the minimums and maximums which remain on certain screens. The three tables comprising the standard are given at right.

TABLE I

Peening Shot Numbers and Screening Tolerances

Shot Number	Shot Screening Tolerance								
	None On Screen No.	Max. On Pct	Screen No.	Screen Aperture, In.	Min. On Pct	Screen No.	Screen Aperture, In.	Max. On Pct	Screen No.
P 157	3½ (0.223)	2	4	0.187	90	5	0.157	5	6
P 132	4	2	5	0.157	90	6	0.132	5	7
P 111	5	2	6	0.132	90	7	0.111	5	8
P 93	6	2	7	0.111	90	8	0.0937	5	10
P 78	7	2	8	0.0937	90	10	0.0787	5	12
P 66	8	2	10	0.0787	90	12	0.0661	5	14
P 55	10	5	12	0.0661	85	14	0.0555	7	16
P 46	12	5	14	0.0555	85	16	0.0469	7	18
P 39	14	5	16	0.0469	85	18	0.0394	7	20
P 33	16	5	18	0.0394	85	20	0.0331	7	25
P 28	18	5	20	0.0331	80	25	0.0280	12	30
P 23	20	5	25	0.0280	80	30	0.0232	12	35
P 19	25	5	30	0.0232	80	35	0.0197	12	40
P 16	30	5	35	0.0197	80	40	0.0165	12	45
P 13	35	5	40	0.0165	75	45	0.0138	17	50
P 11	40	5	45	0.0138	75	50	0.0117	17	60
P 9	45	5	50	0.0117	70	60	0.0098	22	70
P 8	50	5	60	0.0098	70	70	0.0083	22	80
P 7	60	5	70	0.0083	70	80	0.0070	22	100
P 6	70	5	80	0.0070	70	100	0.0059	22	120 (0.00049)

Maximum fines allowed through smallest screen, 3 pct. Percentages given are on the basis of weight as determined by prescribed tests.

TABLE II

Cleaning Shot Numbers and Screening Tolerances

Shot Number	None On Screen No.	Min. On Pct	Screen No.	Screen Aperture, In.	Max. to Pass, Pct	Screen No.	Screen Aperture, In.
1320	4 (0.187)	85	6	0.132	5	7	0.111
1110	5 (0.157)	85	7	0.111	5	8	0.0937
930	6	85	8	0.0937	5	10	0.0787
780	7	80	10	0.0787	10	12	0.0661
660	8	80	12	0.0661	10	14	0.0555
550	10	80	14	0.0555	10	16	0.0469
460	12	75	16	0.0469	15	18	0.0394
390	14	75	18	0.0394	15	20	0.0331
330	16	75	20	0.0331	15	30	0.0232
230	18	70	30	0.0232	20	40	0.0165
170	20	70	40	0.0165	20	50	0.0117
110	30	65	50	0.0117	25	80	0.0070
70	40	65	80	0.0070	25	120	0.0049

TABLE III

Grit Numbers and Screening Tolerances

Grit Number	None On Screen No.	Min. On Pct	Screen No.	Screen Aperture, In.	Max. to Pass, Pct	Screen No.	Screen Aperture, In.
10	7 (0.111)	80	10	0.0787	10	12	0.0661
12	8 (0.0937)	80	12	0.0661	10	14	0.0555
14	10	80	14	0.0555	10	16	0.0469
16	12	75	16	0.0469	15	18	0.0394
18	14	75	18	0.0394	15	25	0.0280
25	16	70	25	0.0280	20	40	0.0165
40	18	70	40	0.0165	20	50	0.0117
50	25	65	50	0.0117	25	80	0.0070
80	40	65	80	0.0070	25	120	0.0049
120	50	60	120	0.0049	30	200	0.0029
200	80	55	200	0.0029	35	325	0.0017
325	120	..	..	.....	20	325	0.0017

Flash Welding Of Sheet Brass

. . . In adapting flash-butt welding methods to nonferrous metals, difficulties have been encountered by the manufacturers of small parts. In this article, which is abstracted from the British journal Welding, the authors give details of a recently established method which has been found efficient for flash-butt welding thin sections of brass.

o o o

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o o o

VERY little published information is available on the subject of the flash-butt welding of brass. A machine of special characteristics is required for such work, and the conditions which always produce a good weld in brass will always produce a good weld in steel of the same section and area. However, the converse is not true, i.e., a machine set for welding satisfactorily a steel section will not normally produce a metallurgically sound weld in the same section of brass. This may be explained by the fact that brass, which melts at a lower temperature and has a small plastic range, cannot be flashed in the same way as steel is usually flashed to produce constant results.

In the normal flash-butt welding procedure for steel the component parts are brought together some time after the welding transformer is energized. The mechanism for producing equally good welds in brass, on the other hand, is rather a combination of the butt and flash-butt processes, whereby the parts are brought into contact before the passage of the current, but under a light constant pressure, so that during the time of current flow only a short flash takes place.

One reference[1] maintains that lead, zinc, tin, antimony, bismuth and alloys in which they are principal constituents, and copper alloys in which any of the above metals are present in large percentages have never been successfully welded by the flash-butt process. Another reference[2] which agrees to a large extent with the opinions of the authors, set forth herein, states that in all of the work on the copper alloys it has been found that the one requisite is that the metal be melted at the time the two parts are given their final push together.

Straight resistance welding, therefore, is not well adapted to the welding of copper alloys. Flash-butt welding, on the other hand, offers a very good way of uniting rods, sheet edges and shapes. The metals are brought into contact with the current off and the consequent arc allowed to play on the surfaces until the metal is molten —in a fraction of a second to perhaps 3 sec—and the final pushup made quickly and lightly. Hook states that this operation must be performed quickly to catch the faces while the metal is still molten and lightly in order to avoid too great an upsetting of the metal while it is still in the hot-short condition. Copper alloys do not possess a low pressure weldable temperature range similar to that of iron or low-carbon steel. The latter becomes plastic for several hundred degrees before it actually melts, and in this condition welds can be made by pressure in a rather wide range of intensity. With the copper alloys, this pressure weldable range, while the metal is still in a plastic state, does not exist. The copper alloy must actually be melted to obtain a satisfactory weld. Since the latent heat of fusion of the copper alloys is rather high, this explains in a measure the high heat energy required to weld even the Everdurs.

It will be seen later that the principles envisaged above are largely true, but the flash-butt welding process, as such, is not as satisfactory as the combination of both the butt and flash-butt processes, i.e., the spring-applied load must be operative before the passage of current. The resistance butt and flash welding machines commonly built for welding steel usually do not have the light pressure and fast action needed for the successful flash welding of copper alloys.

The most important factor to be considered regarding mechanical details of the machine is the design of the moving slide. There should be neither side play nor lift between the slide faces, but at the same time it is most important to insure a minimum of frictional resistance between them. While the buttress or V-bed type of slides may be used with every confidence for steel, provided they are properly maintained, the slight frictional resistance which is unavoidable prohibits their use in brass welding equipment.

[1] *American Welding Society Handbook*, 1942, p. 376.
[2] *I. T. Hook, "Resistance Welding of Copper Alloys," AWS Journal, October*, 1935.

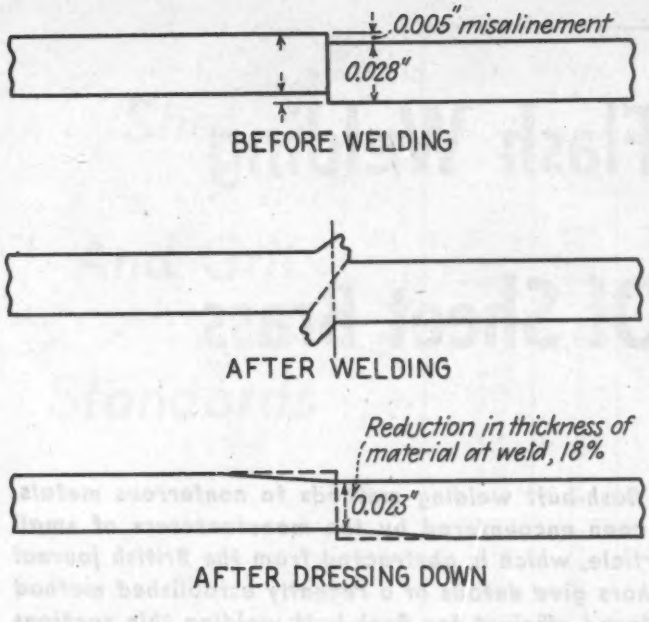

FIG. 1 — Proper alinement of the dies is extremely important for the production of accurate work. Even slight misalinement may necessitate considerable dressing down and resultant reduction in area.

The point of application of pressure to the moving slide should be such that the center of gravity of the section to be welded coincides with the line of applied force. While this may not always be possible due to a variety of shapes and sizes of components, the next best thing is to arrange for the point of application of load to be central with the slides themselves, both vertically and horizontally. In the case of small sections under consideration, the method of application of load to the slide should be by means of a cam placed either horizontally or vertically, and should be such that the cam actuates the slide direct, without transmitting the motive force through a lever. An air cylinder for applying the pressure is not recommended for the following reasons:

(1) The air supply to the cylinder is usually of a variable nature, due to fluctuating demands.

(2) Condensation in the air lines results in water gaining access to the cylinder, causing rapid deterioration of the packing. This allows a seepage of air past the pistons, which may be of a variable nature and is certainly beyond the control of a reducing valve, so that the effective pressure on the piston will be inconsistent.

Preferably the cam should be actuated by a variable-speed drive or similar means of producing the same effect. The reason for the variable-speed drive is to allow a greater choice of flashing times so that the relationship between time of current flow and current magnitude may be finely adjusted. Without this refinement the generating of the cam to suit a particular fixed current and flashing time setting for a given job may well prove to be an extremely expensive and time consuming process. One cam can be made to suit a variety of work, if variable speed drive to it is provided.

In butt welding steel, the method of breaking the primary current prior to final upset has been by means of a simple trip switch actuated by the movement of a stop attached to the moving slide. Other slightly more accurate methods have been to use a similar trip contact assembly working off the cam itself. Both of these methods for breaking the current are too indeterminate for such critical applications as brass butt welding, and a more effective and dependable means has been found in the use of a micro switch equipped with micro adjustment to enable minute changes in the point of current cut-off to be made.

Misalinement of the dies, even only of the order of 0.005 in., has been found to be detrimental to the finished product; for, in cleaning of the flash after welding, the step due to misalinement of the dies necessitates dressing down the components on either side of the weld, so that the section at the weld may be reduced by as much as 18 pct of the original thickness. Fig. 1 shows diagrammatically the effect produced.

A similar effect can be produced when the die material deforms near the edge of the die under the clamping pressure, that is to say, the edge of one component part will skid over the edge of the other when pressure is applied, as shown in fig. 2 at A. This effect is accentuated by the necessity for relieving the contact surfaces of the clamps in order to insure perfect contact near the weld area. It will be seen from fig. 2 at B that if the pressure were applied uniformly over the whole surface, any doming of the dies due to localized heating would result in loss of clamping pressure and contact near the weld area. On the other hand, recessed clamps as at C,

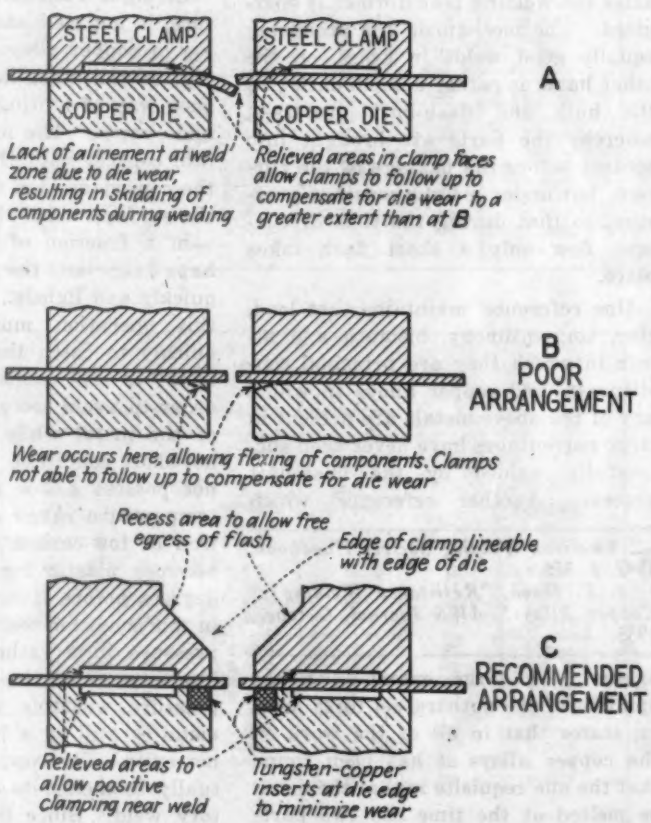
STEEL CLAMP
STEEL CLAMP
COPPER DIE
COPPER DIE
A
Lack of alinement at weld zone due to die wear, resulting in skidding of components during welding
Relieved areas in clamp faces allow clamps to follow up to compensate for die wear to a greater extent than at B
B
POOR ARRANGEMENT
Wear occurs here, allowing flexing of components. Clamps not able to follow up to compensate for die wear
Recess area to allow free egress of flash
Edge of clamp lineable with edge of die
C
RECOMMENDED ARRANGEMENT
Relieved areas to allow positive clamping near weld
Tungsten-copper inserts at die edge to minimize wear

FIG. 2—The design of dies plays an important part in the production of satisfactory flash-butt welds.

do tend to compensate for any wear which takes place, because of the ability of the clamps to follow up the wear. Hence this type is recommended.

Tungsten-copper inserts should be fitted at the points where maximum wear tends to take place. It has been found that without such inserts only a very few welds could be made before misalinement and distortion at the weld area takes place. The extra trouble required for installing these inserts in the dies adjacent to the weld is fully recompensed by longer die life and less frequent maintenance.

Having insured that the dies are satisfactory from the point of view of both design and manufacture, the next point to be considered to insure good alinement is that the machine platens are flat and are themselves capable of proper alinement.

The methods of rating machines by their kva is not yet properly standardized, and recent surveys have shown that welding machines made by different manufacturers all reputed to be of the same rating, actually vary enormously. It is the opinion of the authors that the required electrical output of the machine is best ascertained from its short-circuit, secondary current capabilities. Normally for a given transformer, provided it is not overloaded, open circuit voltage is directly proportional to short-circuit secondary current, and most machines of the type in question give 4000 to 5000 short-circuit secondary amp for each open-circuit secondary volt. The short-circuit current may be measured by means of a valve voltmeter supplied by the voltage generated from an air-cored loop around a copper bar placed between the platens. Where no facilities are available for measuring short-circuit current, a rough approximation may be made by using the above formula based upon open-circuit voltage.

Development Work

At the commencement of the development work on welding thin sections of brass, the first attempts were made by the flash-butt welding method, that is to say, the welding transformer was energized before the pieces came into contact. The movement of the head was imparted by means of a cam with a very fast lead which gave as rapid a movement to the head as was mechanically possible. A slower movement was tried but this was found to be unsatisfactory due to the accelerating nature of the speed of burn-off. The use of the rapidly moving slide necessitated a relatively high current which resulted in excessive local burning away of the material, giving a joint welded only in places, the unwelded parts obviously having been blown away by excessive local flashing. This excessive local flashing could be partly eliminated by insuring that the edges to be joined were accurately prepared. Accurate preparation involves the work of an expert toolmaker, but even then only a percentage of the welds are acceptable.

A considerable amount of time was spent in attempting to obtain a setting for the machine which would give consistently good results, but this purpose was not achieved, in spite of the fact that the cams which controlled current cut-off were fitted with micrometer adjustment. The reasons for this lack of success in consistently flash-butt welding brass were probably:

(1) **The accelerating nature of the flashing away of the material (which in any case is inconsistent) presents insuperable difficulties in generating a suitable cam.**

(2) **Slight inaccuracies of current cut-off give widely different results. If the current is cut off too soon insufficient heat is generated and an excessive pressure is then exerted on the cold material, which results in buckling and misalinement and insufficient fusion at the weld zone. An example of this is shown in fig. 3. On the other hand, if the current is cut off too late, too much heat is generated, and the peak of the cam may be reached or passed, resulting in either insufficient or even complete lack of forging pressure. A section of a weld made under these conditions is shown in fig. 4. This shows complete blowout at the weld zone.**

From these results it was concluded that a different welding principle would have to be adopted, and at the same time close analysis of the welding conditions used would be necessary.

It was decided that it was most important to provide a suitable means for insuring that the rate of burn-off was followed up very closely by the movement of the slide, and for this reason a spring-loaded slide was used, with the material in contact under pressure before energization of the welding transformer. Particular attention had to be paid to the following factors before the conditions for satisfactory butt welding of brass were established. In the first instance a cam with an accelerating lead was used to supply the pressure through a compression spring housed along the center of the moving slide. The slide faces were of the buttress type and were accurately bedded and alined to insure a minimum of frictional resistance. The current-breaking switch used in this case was a tappet type actuated by the moving slide. With the above arrangements a larger number of welds were made using a wide range of machine settings, but with the best setting selected. Although a substantial improvement over the flash-butt welding process was obvious, still only 50 to 60 pct of the welds produced were acceptable. This

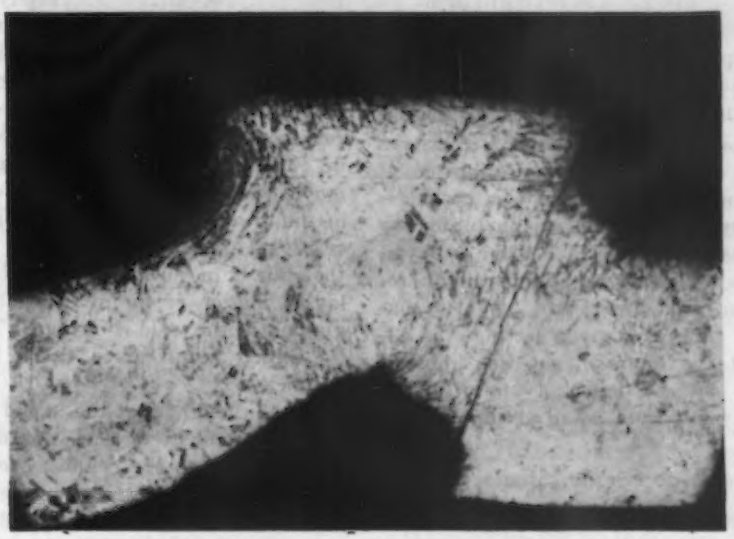

FIG. 3—Photomacrograph of a flash-butt weld in brass, showing the effects of a too early current cut-off.

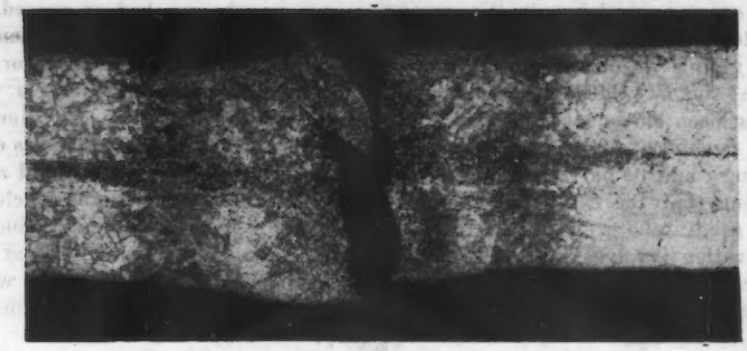

FIG. 4—Cutting off the current too late may result in a blowout at the weld zone as shown in this photomacrograph of a brass butt weld.

confirmed the theory that the butt-welding process was better in principle than the flash-butt welding process for the particular job in question, but pressure and time conditions were still erratic.

The next step was to fit a thyratron type timer, which was calibrated at the outset by means of a cycle recorder. The timer was actuated by means of a foot switch after the component parts had been brought together under pressure. When constant time at a given setting was assured, the improvement was immediately obvious, but still up to 30 pct poor welds were being produced.

Slide Friction Studies

The one remaining variable which had not been checked, due to obvious difficulties, was the amount of applied force lost through the friction of the moving slide. A rough estimate of the maximum friction obtained with the buttress slides accurately prepared as they were, was obtained by means of a spring balance pulling on the end of the slide, with cam and compression spring disconnected. A reading of between 40 and 50 lb could be obtained before the slide began to move, which represented some 40 pct of the total load applied. Although the frictional resistance decreases when the slide is in motion, the variable delay in motion of the slide at the beginning of the weld is obviously a factor which is prone to cause inconsistencies.

It was thought that the initial delay in the movement of the slide due to frictional resistance could be reduced by increasing the initial pressure. This pressure was therefore increased from 100 to 130 lb, but this resulted in the components skidding over each other, and a tendency to distort at the weld zone, even though the other variables were adjusted over a range to attempt to compensate for the higher pressure. This condition pointed to the fact that the right setting would certainly necessitate a light pressure, and in view of this, the only answer to the problem was to attempt to eliminate almost entirely the frictional resistance at the slides. This was accomplished by redesigning and modifying the slide thought to be the most suitable for the job, and involved floating the slide both vertically and horizontally on ball races, keeping the distance between the centers of the races as far apart as possible to avoid torsional side play and lift.

Tests carried out with this form of virtually frictionless slide with the force applied by means of a compression spring gave 100 pct acceptable welds for the first series of 20. However, when a further series of 20 welds were made, only 80 pct good welds were obtained. A further series showed another drop in the percentage of good welds obtained. It was obvious, therefore, that conditions were changing, and since current and time were constant, the only remaining variable was pressure.

The machine was therefore stripped and a careful examination made to ascertain the reason for the change in pressure. It was found that a certain amount of flash from the welds had gained access to the slide surfaces on which the ball races ran, causing momentary seizing of the moving parts. To avoid a recurrence of this, guards were fitted parallel to the direction of movement and of such design that all extraneous material was excluded. This design presented certain difficulties, since care had to be taken to avoid the possibility of restricting the movement of the slide, and to avoid presenting a leakage path for secondary current.

A further batch of test welds were then made, with only slight improvement over those made in the last of the previous tests. The one remaining factor which had been overlooked was the functioning of the compression spring which applied the load to the head. On examination of the housing of the spring it was apparent that in the course of the repeated recoils in the previous two sets of tests the bore of the housing had become scored by the movement of the spring, because undoubtedly it had buckled under load, resulting in erratic recoil due to frictional resistance between the spring and the bore of the housing. Increasing the bore of the housing was out of the question, because this would have allowed more distortion to take place. A smaller bore on

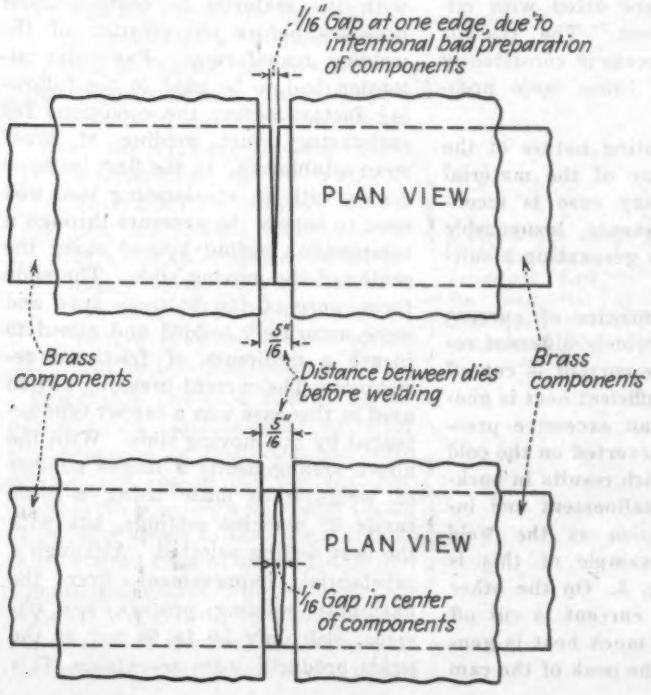

FIG. 5—Tests indicate that butt ends purposely badly prepared, as shown, do not affect the quality of the weld if all other factors are properly controlled.

the other hand would have caused coil binding. The entire removal of any internal or external restraint on the compression motion, due to spring guides, would not have been a practical proposition if spring distortion were to be avoided. By reason of this fact, recourse was had to the use of two simple tension springs placed symetrically on either side of the slide and anchored to brackets so that their effect was to pull the moving slide toward the stationary one rather than to push it, as in the case of the compression spring.

The slides were now frictionless in movement, both on the mountings and in the pressure mechanism. Further weld specimens were then prepared, and out of a batch of 50 the results were 100 pct acceptable from the point of view of visual examination. These specimens had been previously prepared by accurately dressing the edges prior to welding in order to keep this factor as closely under control as were pressure, time and current. Since accurate preparation would never be a production process, the next step was to determine the extent to which welding conditions were affected by the condition of the butt joints prior to welding. This was done by deliberately presenting badly butted joints for welding, taking care, however, that all other variables were under close control.

In this experimental stage flat strip only was under consideration, the dimensions of the section being 0.025 x 1 13/16 in. The type of bad preparation used is shown in fig. 5. One hundred welds were of uniformly good appearance, equal to those made with good preparation. A typical photomacrograph of a section of a weld made under the above conditions is shown in fig. 6, which shows the cast structure of the material around the weld junction, and the lack of blow holes and inclusions. Good alinement was maintained, as can be seen, in spite of the unfavorable circumstances.

FIG. 6—Photomacrograph of a weld made in brass strip with badly prepared ends, but with proper alinement of stock. Notice the lack of blowholes and inclusions.

The recommended setting for the brass section under consideration (0.028 x 1 13/16 in.) is as follows:

Short-circuit current
10,000 to 11,000 amp

Applied load
112 lb

Flashing time
5 to 8 cycles (50 cycles per sec)

The corresponding settings for welding steel of the same section would be:

Short-circuit current. 14,000 amp
Applied load.....120 lb
Flashing time..... 18 cycles

A considerable latitude either way in the choice of variable is permissible in the case of steel, but in the case of brass a much narrower choice of conditions is presented. The above settings were satisfactory not only for flat sheet, but also for a variety of shapes and contours, provided the clamping conditions were such that the work was in intimate contact with the dies near the weld.

From the foregoing it may be concluded that the flash-butt welding of copper alloys is entirely practicable, provided properly designed equipment is available, and adequate care is taken in making mechanical and electrical adjustments.

Stabilizers Prevent Disintegration of Refractories

STRUCTURAL disintegration of refractory shapes made from zirconia can be eliminated by the addition of certain oxides that stabilize the crystal form of the material, and by special heat treatment, according to R. F. Geller, National Bureau of Standards.

Although zirconia has been used for several years as an opacifier in enamels and to some extent in glazes, its use as a refractory has not increased, even though it is available in a very pure state at comparatively low cost and possesses many valuable properties such as high melting point, chemical stability, and hardness.

Its disadvantage is that when made into refractory shapes these are inclined to disintegrate rather rapidly. This manifests itself by progressive cracking until the entire shape has broken up into small, roughly cubical pieces. The cracking is caused by large and very rapid changes in volume that accompany alterations in the crystalline structure of the material.

As published information indicated that the addition of certain oxides would change this crystal form to one of greater stability, experiments were made at the Bureau using the oxides of cerium, yttrium, silicon, magnesium, and calcium. The specimens of these mixtures were heated to various temperatures and their length changes determined during both heating and cooling.

The results show that irregular thermal length changes were prevented. However, expansion during heating and contraction while cooling were always relatively high, and although the tendency to structural disintegration is overcome, the resistance of the material to severe thermal shock is still comparatively low. This is to be expected, because of the poor heat conductivity of zirconia as compared with other materials of high thermal expansion, such as alumina, magnesia, and beryllia.

Edge Preparation Of Ship Plate

. . . The utilization of mechanical cams in conjunction with a flame-planer permits trim edging of plated edges to any desired contour and combination of bevels within limits of ± 0.003 in. High quality welds result, and twice the production rate is obtained than by use of hand-operated cutting equipment.

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By CYRIL PROVO HUBERT

Chief Loftsman, California Shipbuilding Corp., Wilmington, Calif.

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SINCE a welded ship is a constrained or redundant type of structure, the component parts of the vessel must be able to adjust to each other in such a manner that the magnitude and extent of residual or locked-in stresses in the welding of the structural members will be reduced to a minimum. Quite well recognized by welding engineers is the fact that perfectly matched plating held jointly is an inseparable and underlying part of the whole problem of welding.

For other articles on welding and residual stresses in ship construction, see THE IRON AGE, *issues of Jan. 6 and Oct. 26, 1944, and Oct. 28, 1943.*

In the Liberty and Victory type of cargo ships, the entire shell structure is of all-welded construction and consists of a series of plates fitting each other with square butt-welded seams, welded both sides, wherever machine welded. Therefore, as previously stated, it is readily seen that the plates must be accurately cut so that each joint and seam fits tightly to each other in order that machine welding in the prefabrication process may be advantageously employed, with edges fitted tight so as to exclude a shipfitter's feeler and prevent the weld metal from flowing through.

In making an exploratory study of prefabrication operations in order to devise ways and means of maintaining closer tolerances between the contact surfaces of the butts and seams of shell plating and avoid variable width jointing, it appeared that a solution to the problem could be logically arrived at by the introduction of cam-cut plates; an innovation in the annals of ship construction that supplants the slower, outmoded traditional media of template application.

Certain facts stood out from these studies so preeminently that every endeavor was made to use them as a basis in determining practical shop practices. These facts are:

(1) In order to prevent excessive warpage caused by the large quantity of heat absorbed by the shell plates when burning each edge to contour individually, it was found expedient to counteract the distortion due to uneven cooling by flame-planing opposite edges simultaneously.

(2) The one-pass method of shaping steel by means of fully mechanized equipment in cutting shell plates to any shape or curvature was capable of being effected when used in conjunction with a Linde flame-planer. The need for this machine accuracy in cutting the shell plates has led to the development of shell-plate cams which are made for each plate.

This method of attack produced the prepared plate identical in shape to the shell plate development as laid off in the mold loft. It then became a simple matter to position an application template for defining the neces-

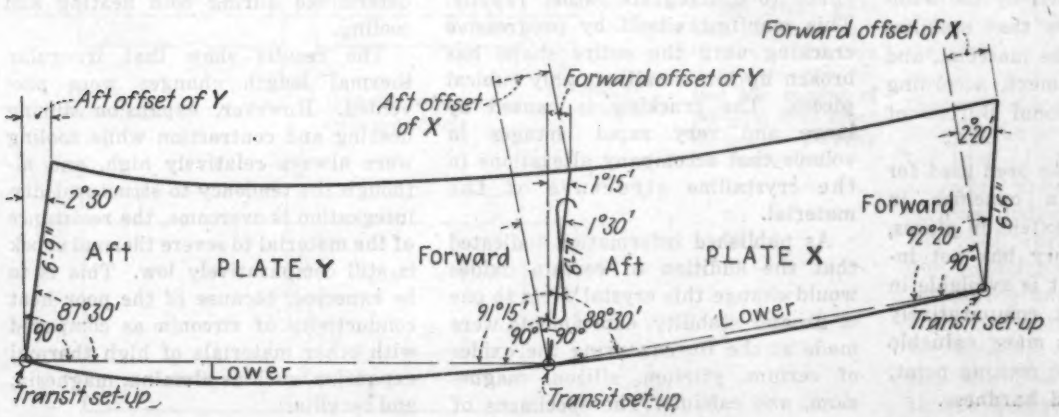

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FIG. 1—Plate situation measurements and orientation data used in establishing cam measurements.

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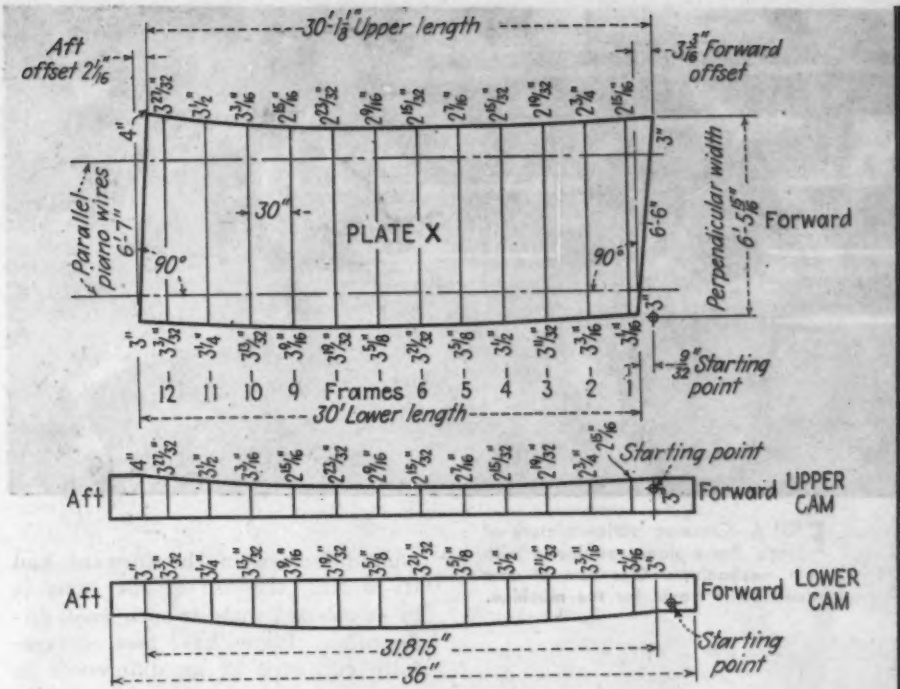

ABOVE

FIG. 2—Cam measurements for an individual shell plate.

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RIGHT

FIG. 3—A typical example of cam pattern or application template used in fashioning metal cams. Light plywood is employed for these cam patterns.

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sary molded frame lines, and water and buttock reference lines.

Considering the technical aspects of the subject, in order to make cams for any particular shell plate, certain fundamental measurements must accurately be taken so that the cams will duplicate requirements. The measurements necessary for this duplication can perhaps be best illustrated by referring to a typical analysis of any two successive plates X and Y, in a particular strake; the details in fig. 1 being a serviceable example. A surveyor's transit is set-up at the lower sight edge and centered directly over the point where the aft and forward butt intersects the lower sight edge. Then by taking a shot to the lower forward and aft ends of plates X and Y respectively, the base lines are immediately established. The transit is then oriented with a shot taken to the upper intersection of the butt with the sight edge, thus determining the angle that the seam makes with the established base lines of the two successive plates. These angles are not only important for determining the slope of the end cuts, but also accurately determine the forward and aft offsets from which the relative starting position of each curve can accurately be retained. Then, by knowing the angles and the measured slant widths of each end, the perpendicular width of the forward end can be calculated thus giving the forward starting width of the flame.

For each shell plate a separate pair of cams is made, one for the upper curve and one for the lower curve. Using the delineations in fig. 2 as an example, it is assumed that cams are to be made for a shell plate X having a lower length of 30 ft, an upper length of 30 ft 1⅛ in., a forward width of 6 ft 6 in., and an aft width of 6 ft 7 in. Two piano wires are placed parallel to each other on the upper and lower edges of the developed shell plate on the mold loft floor, the lower wire being considered a base or reference line and placed 3 in. away from forward and aft sight edges. Since the plate is 1 in. wider on an aft end, the upper piano wire is placed 4 in. away from sight edge at aft end, and 3 in. away at forward end. Hence, the difference in end widths is taken care of in the upper cam, the lower one always starting at 3 in. and ending at 3 in.

When the wires have been made parallel and the differences in the end widths taken care of on the upper sight edge and wire, the perpendicular distance between the wire and sight edge at the molded line of each frame, or rib is measured. These ordinates are then taken and plotted on a piece of light plywood, about 6 in. by 36 in. long. The frame lines are laid out on this wood, the points plotted and a curve is drawn in, connecting these points. The pattern is then cut on the band saw and sanded smooth with the result that this faired line represents the exact duplicate of the curve on the floor; the patterns shown in fig. 3 being a typical example. This curve is then transferred to a metal plate of the same size, scribed, cut and filed smooth. The metal plates are then rolled so that they may be mounted on a pair of drums operating on a shaft placed on the gantry carriage of the flame planer, as shown in fig. 4.

The cams are mounted on the longitudinal carriage through a series of gear reductions, enabling the operator of the flame-planer to accurately

FIG. 4—Close-up action picture of Linde flame-planer equipped with cam mechanisms. One turn of cam equals 30 ft travel for the machine.

duplicate each plate without use of templates in the cutting process. By using a reduction gear box and a set of chains the length of cams is cut down about 11 to 1; hence, 1 in. on the plate equals 0.09 in. on the cam. This reduction is connected to a flat wheel on the side of the longitudinal carriage. Two cam followers are used to actuate the edge-preparation assemblies. These followers are in constant contact with the cam and when the carriage moves forward the cams turn one turn to the full travel of 30 ft for the machine. Due to such a great reduction, namely, 11 to 1, the resulting curves plotted on the cams are so condensed and powerful that the smallest irregularity of fairing of the lines on the loft floor is readily detected with the result that the shell plates are cut extremely accurately, and twice the production rate is obtained than by use of hand-operated cutting equipment.

Since the upper and lower lengths as well as forward and aft widths quite often are different, the ends are therefore not necessarily parallel, and provision must be made for the curves to be synchronized properly. The upper and lower curves must start and maintain their proper relationship at all times. In the above example, there was a forward offset of 3 3/16 in. With the length condensed to about 11 to 1 this means that the upper curve must start 0.09x3 3/16 in., or 9/32 in. of the lower curve. A small hole is drilled in each cam at the proper starting point. A bolt-like trigger instantly lines the cams in their correct synchronized position when the cut is started.

By means of an end-cutting attachment mounted on the transverse carriage, the operator of the flame-planing machine can simultaneously cut the ends of the shell plates to the desired angle while the upper and lower surfaces are being cut by the cams. The entire cutting operation of all four sides can, therefore, be precision cut without use of templates, thus saving considerable time and also eliminating the irregularities of a template cut plate.

Although shell plate X shows but 1-in. difference in the forward and aft widths, the use of the cams is by no means limited to such small differentials. Plates have been successfully cut with 12 in. differences in end widths by dividing this equally between the two cams.

It is not practical to fashion cams that would have more than a 6-in. rise because the resulting curve becomes too steep when rolled. This causes too much angularity between the cam followers and the cam surface tending to create a wedging action instead of a smooth actuation of the flame preparation assemblies. Hence, there are several extreme shell plates that have to be cut to template.

Since the governing lengths of the plating of the various shell strakes of the Victory ship were found to be 27 ft in contrast to 30 ft for the Liberty ships, the scale was changed to better utilize the cam plate and also to reduce angularity of curves. Consequently, interchangeable cam drives were introduced.

Individual Cams Necessary

A question that comes up for recurrent discussion concerning the design of this type of cam is: Why the necessity of individual cams for adjoining sight edges of seams? This can best be answered by referring back to the cam patterns pictured in

FIG. 5—Comparative methods of unfolding a zoned sphere and that of a ship's hull plating.

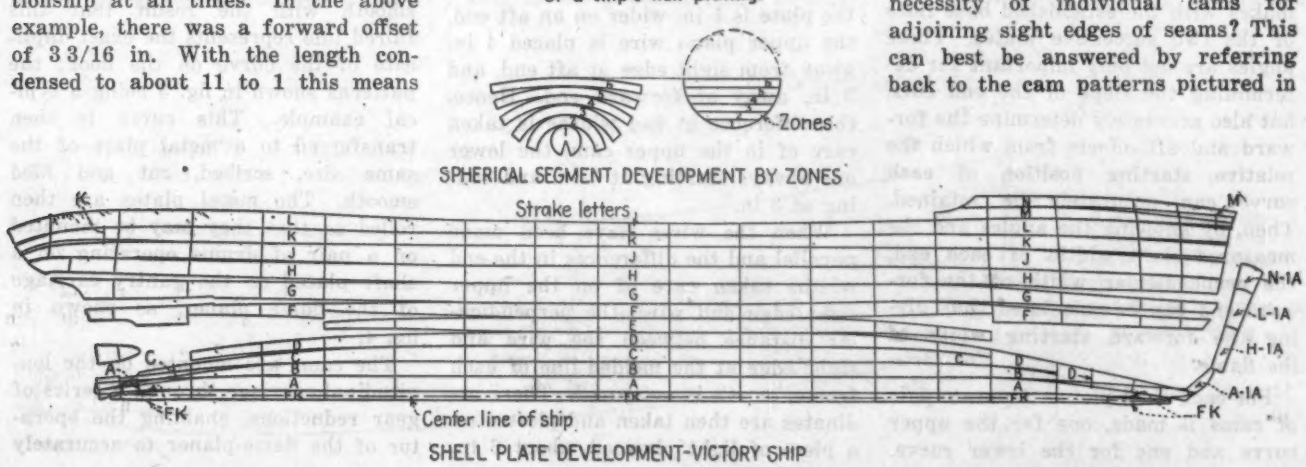

fig. 3; depicting how sight edges diverge in flat development and the lack of similitude of contours.

This variance is best explained in the comparative methods of unfolding a zoned sphere and that of a ship's hull plating, shown in fig. 5, displaying clearly the characteristic features of similarity in which the close connection between developments is manifested. However, it must be remembered that both forms have double curved surfaces embodied in their contour. In the case of the hull form, after leaving the parallel middle body

FIG. 6—General view of Linde flame-planer, flame cutting both longitudinal edges of a shell plate simultaneously.

or dead flat section, the frame lines develop not as straight lines but as curves because, fore and aft, the plane of the frames is not normal to the shell contour. Consequently, wherever there is fore and aft shape and frame shape in a plate at the same time, there will be a bow in the shape of the frame line across the plate; therefore, it becomes obvious that the degree by which one plate exceeds the other in excessive shape is the controlling factor in defining the related contours.

The Linde flame-plane, shown in fig. 6, was developed by the Linde Air Products Co. in collaboration with the engineering department of the Link-Belt Co., Pacific Div. The oxyacetylene process is utilized for flame cutting and beveling the edges of steel plates preparatory to welding.

The system consists essentially of three box-type gantry carriages, two of which are transverse carriages, each having one edge-preparation flame cutting assembly that operates on a pair of guide rails and cuts transversely. The main, or longitudinal carriage has two edge preparation flame-cutting assemblies which can be adjusted to any desired width for longitudinal parallel cutting. All three of the gantry carriages have two pairs of wheels, V wheels and flat wheels, which operate on two parallel tracks spaced 14 ft and extending 75 ft in length. The V wheels are used to guide the carriages, while the driving power on the longitudinal carriage is supplied by a small electric motor driving through a flat wheel.

The roller-type, vertically free-cutting heads follow undulations of the plate surface permitting the nozzle to maintain the correct setting distance from the plate at all times and thus produce an even and accurate depth of bevel at high speed. Nozzle blocks containing the requisite number and position of the cutting nozzles assure accurate and uniform edge preparation. The flame cutting speed, lengthwise and transverse, is adjustable to suit the operation and thickness of plate being prepared.

By the introduction of a post-heating flame ahead of the second or trimming flame twice the amount of flame cutting can be accomplished than if a single blow pipe were utilized, provided the relationship of the flames are such that the trimming flame has been set to take full advantage of the preheating effect of the post-heating flame. Multi-face cutting representative of the typical joint details met in ship construction in the trimming and beveling of ship plate edges can be accomplished with astonishing rapidity throughout the operating cycle of the cams when cutting to contour. However, in any multiple cutting the various flames must not foul each other.

The planer table comprises roll units, each consisting of disks on a roller-bearing shaft supported on a substantial structural steel base, with disks spaced to give proper support to the plate. They are operated through inter-connected steel roller chain drives in three banks constituting the receiving, cutting and discharge section of table. Each bank is separately driven by a motorized speed reducer.

Upon placing the plate on the receiving section, the entire operation of plate handling is semiautomatic, under the control of the operator at all times, by means of suitably located push buttons and air valves.

(CONTINUED ON PAGE 148)

Metals, Finishes, and Finishing

. . . This is the second section of a four-part article, in which a great deal of hitherto widely scattered data are correlated to aid in the selection of the proper metal, finish, and finishing process. Last week a full index of data to be presented in this series was given when attention was devoted primarily to spot tests for identification, porosity tests for electro-deposits, comparison of pickling-degreasing cleaning procedures, electrolytic and acid pickling, removal of oils, and various cleaning operations. Herein, interest is centered in electropolishing, and the selection of surface finishes for functional and decorative purposes.

WHEN a selection is to be made from the mechanical methods for deburring, polishing and buffing, a comparative consideration should also be given to electropolishing. Electropolishing may serve either to supplement or to supplant mechanical (wheel or barrel) finishing in some production operations. The scope of electropolishing is not as broad as that of mechanical procedures; however, it does offer a new approach to secure the following advantages:

(1) A uniform and brilliant surface without grit marks.

(2) A surface which serves as an ideal bond for plated metals, due to the absence of mechanically damaged metal, strained metal, embedded dirt and oxides.

(3) The ability to process inaccessible areas which may be impossible to polish or deburr by mechanical methods.

(4) The electrobuffing of a plated metal, subsequent, of course, to electropolishing of the basis metal (prior to plating) enables the direct application of the final plate. The complete electrolytic procedure results in less off-color work than when a mechanical procedure is followed.

(5) The removal of 0.001 in. of metal usually presents full luster and requires 8 to 30 min. The removal of 0.0002 in. of metal generally suffices in electrobuffing. In areas where it may be difficult to finish-machine, electropolishing operations may be arranged to selectively remove up to 0.005 in. or even more of metal.

(6) In mechanical operations some difficulty may occur in the removal of polishing and buffing compounds; the absence of such compounds in electropolishing is an asset.

(7) The electropolishing of stainless castings and parts, following sand or shot blasting, increases the corrosion resistance to a considerable extent.

(8) Electropolishing presents a method for obtaining two-tone and relief effects, which is of especial interest on stainless steel and for highlighting dye-colors on aluminum.

(9) When used to supplement mechanical polishing, electropolishing reduces the time of the mechanical operation and removes grit marks.

(10) In cathodic cleaning, in pickling operations, and in plating baths hydrogen embrittlement occurs. Anodic electropolishing tends to remove hydrogen occlusions and thus relieves resulting embrittlement following the mentioned operations.

(11) The electropolishing of plated nickel eliminates the danger of softening hard-nickel deposits. Mechanical polishing generates frictional heat, and at times unless great care is practiced a temperature of 500°F may be reached and nickel loses its hardness at around 500°F.

(12) Electropolishing baths are remarkably free from control and bath contamination difficulties and in these respects they are quite different from plating baths.

(13) Drawn parts may be rippled or distorted in areas under stress by mechanical polishing or buffing; no such tendency occurs in electropolishing operations.

Electropolishing baths are not blanket processes and the electrolyte and procedure must be "cut to pattern." Many patented baths exist though the sulphuric-phosphoric acid solutions predominate in production operations.

Patent Nos. 2,282,350; 2,282,351; 2,315,696; 2,334,698; 2,334,699; and 2,338,321 are typical baths.

OPERATION: Voltages are from 12 to 40, current density range is usually 100 to 500 amp per sq ft at temperatures of 100°F to 275°F. Both heating and cooling coils may be required. Tank linings and racks, etc., are lead, stainless steel or nickel. The work and/or the solution is agitated, or a still operation may be required.

Stainless steel, aluminum, copper alloys, nickel and its alloys and various steels may be electropolished.

Notes on Selection of Surface Finishes For Functional and Decorative Purposes

Abrasion Resistance: Table XVIII tabulates the Brinell hardness numbers of electrodeposits. The higher the Bhn the harder the deposit and the greater its resistance to abrasion and cutting or scratching actions (comparing equal thicknesses of deposits). Hard-chromium, hard-nickel, decorative nickel-chromium, nickel-rhodium, nickel deposits and anodic films on aluminum, in the order named, offer the greatest resistance to abrasion and scratching. Other metal deposits and single coats of lacquer or paint impart only comparatively casual protection. Triple coats of some synthetic lacquers, of which two are baked coats, have an abrasion resistance nearly equal to anodized aluminum. Porcelain enamel has a resistance to abrasion and cutting effects about equal to hard nickel.

Adherence of Deposits: The anodic films produced on aluminum and magnesium are integral with the surface of the basis metals, so the films have practically perfect adherence. The adherence of electrodeposited metals is superficial and is dependent on many factors, as noted in table XXI. The factors controlling the adherence of paint and lacquer coats are detailed in later tables. Specifically, (1) cast iron with bright nickel deposits, (2) zinc with nickel (other than nickel deposited from special electrolytes), and (3) chromium-steel alloys with deposits other than chromium will

Processes *Electropolishing*

By EDWARD ENGEL

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have poor adherence. Porcelain enamel will not withstand distortion without lifting.

Films produced on metals by means of certain chemical immersion processes are shown in tables XXII, XXIII, XXV; anodic treatments of aluminum and magnesium are shown in tables XXII, XXIII; sand blasting of castings and chemically created etches (to a less degree) improve paint and lacquer adherence.

Assemblies: Surface treatments of assemblies may present restrictions, as follows:

(1) The chromium plating of assemblies of intricate shapes, or involving other than shallow recesses, may be expensive or even impossible to accomplish.

(2) The electroplating of assemblies embodying different alloys may present difficulties in cleaning preparation.

(3) Aluminum or magnesium may not be anodized in assembly with other metals, unless it is practical to mask out the latter metals with stop-off lacquer. Assemblies embodying solder, brazing alloys or eutectic welding alloys may not be anodized. High-temperature welding alloys may be anodized.

(4) Work-hardening alloys of aluminum such as 2-S, 3-S, 52-S will not receive an equal anodic oxide film as 17-S or 24-S (or other copper-containing aluminum alloys) when the two

TABLE XIII

BARREL DEBURRING — POLISHING — BUFFING

Factors	Tumbling	Deburring	Rolling	Burnishing
Operation	Cutting-down	Selective cutting-down	Polishing and light cutting-down	Buffing
Equivalent wheel or manual operation	Grinding and snagging	Grinding and filing	Polishing	Buffing
Work	Castings and forgings	Castings and forgings and machine-screw products	Castings, forgings, stampings, and screw-machine products	←
Size limitation	Longest dimensions NOT over 6 in., with exception of rods			
Shape limitation	Work with sharp edges or thin cross-sections or interlocking parts, and hollow and drilled sections present difficulties.			
Dimensional changes	Considerable	Less than in tumbling	Some cutting-down, but to a controllable degree	Not appreciable
Surface appearance	Even	Even	Smooth	Lustrous
Effect on metal	Tends to neutralize strains	None	None	None
Other effects on surface	Removes skin, scale, burrs, fins, corners, etc.	Removes burrs	Removes flash, wire-edges, pits, rough spots rust and light burrs, and round corners	Closes pores
Medium	Annealed metal slugs, stars, jacks, punchings	None	Metal tacks, slugs, steel balls, steel wool. Softer working medium used than in burnishing	*Self burnishing or hardened steel balls or odd shapes; ratio balls to work = 1:2
Abrasive	With or without pumice, slag, chips, sand, etc.	Granite or other equivalents	Cinders, slugs, sand, alundum, emery, carborundum, pumice. For brass and aluminum—Crocus lime, chalk, meal, pumice, felt, maple, lignum vitae, etc.	None
Dry operation	Seldom	No	Screw-machine products in dry, fine sawdust for brightening	No
Wet operation	Usual	Solvent soap type of lubricants	Content of water regulates extent of cutting-down action	Carefully selected lubricant or soap
Chemicals	Oxalic acid or cyanides aid the removal of scale	Proprietary compounds	Sulphuric or hydrochloric acid for removal of scale. To improve the color of steel use tartaric acid or a cyanide; sodium silicate may be added for soft metal	No, though with brass a cyanide solution may be added
Operation on light metals	——	Low rpm	Fine, soft abrasives with plenty of water. Low rpm. Fine, dry polish for soft metals 6 in. vegetable ivory	Small balls, low rpm, 30 to 40 average rpm.
Operation on heavy metals	——	Higher rpm	Coarser and harder abrasives and with less water and greater rpm than with light metals	Coarser balls and higher rpm, 40 to 60 rpm.
Type of Barrel	Horizontal	Horizontal	Open-end tilting for small parts; horizontal may be used	Horizontal (small)
Time of operation	1 to 10 hr	2 to 24 hr	Aluminum, 1 to 20 hr; brass and bronze, 1 to 15 hr; malleable castings, 30 to 40 hr; grey iron, 70 to 80 hr; hot-rolled steel, 50 hr; stampings, 10 to 100 hr	20 min to 10 hr (silver 20 min)

*Burnishing balls are force-dried and treated with a rust preventive to inhibit rust formation when not in operation.

One difficulty in barrel operations is in keeping the abrasive materials in working suspension. Greater efficiency and shorter cycles may be obtained when a proprietary material is used to aid in the suspension of the abrasives. Abrasives which remain at the periphery of the barrel do little work and are short lived. This material also prevents the metal media from rusting between operations.

Overloading of the barrel is one of the major sins in barrel operations, even worse than excessively high speed.

Barrel polishing or burnishing in high and narrow barrels closes the pores of the plated metal and helps eliminate spotting-out to even a greater extent than alternate hot and cold-water dips do, following certain plating solutions.

types of alloys are in assembly under anodic treatment.

(5) It is practical to consider the selection of aluminum and its anodizing and dyeing for deeply recessed parts and intricate assemblies. Irrespective of other cost considerations the anodic treatment and dye coloring of an aluminum assembly may be possible while the decorative chromium plating of an assembly of steel or other metals may not be feasible due to the relative poor covering power of the chromium electrolytes. The alternate procedure of plating each part of the assembly separately may result in higher final production costs than an aluminum assembly and its anodizing and dye coloring.

Buffability: Table XVIII lists the comparative buffabilities of electrodeposits. Buffing is not an inconsequental part of finishing as to comparative cost factors.

Conductivity (Electrical): Anodic oxide films on aluminum have dielectric values of 3 v to 500 v, depending on the length of treatment and the basis alloy. On some electrical devices and on bath room fixtures the electrical insulating values of anodized aluminum (plain or in dyed colors) may serve as a safety measure against electric shock. Organic coats have high dielectric values. Some chemical immersion films have electrical resistance though not high enough to be of practical value. Most other deposits are electrically conductive—see table XVIII.

Conductivity (Thermal): Silver, copper, aluminum and chromium, in the order named, are the better thermal conductors. Anodized aluminum and organic coats are the least heat conductive. Copper is nearly twice as conductive as aluminum, aluminum is over three times more conductive than chromium, and the latter is 40 pct greater in conductivity than steel or iron.

Corrosion Resistance: Zinc and cadmium are protective electrolytically to iron, steel, brass, copper and aluminum. Anodic films on aluminum, magnesium, zinc and cadmium and certain chemically produced films on metals are protective as is zinc chromate primer. Other inorganic d- posits and organic coats retard corrosion only to the measure of their impermeability; thus the extent of their protective value is dependent on their relative non-porosity and film thickness to prevent the entrance of moisture and air. Tables III, IV, V, XXII and XXIII present corrosion value details. Table XVIII lists the porosity ratings of electrodeposits. Certain proprietary white-alloy deposits are electrolytically protective

TABLE XIV

POLISHING WHEEL (TYPICAL) OPERATION DATA

Metal	Polishing Grit Size	Type of Wheel	Result
Aluminum	Pumice grease compound	Tampico, or horse hair	Satin or brushed finish; very little cutting down
Aluminum	Rouge	Loose, or spiral sewed	Mirror
Aluminum	Grease stick	Loose or spiral sewed	Mirror
Aluminum	(Slow medium buff) tripoli 20-70	Loose, or full disk	Satin to mirror
Aluminum	(Hi-speed-auto) tripoli 12-70	Loose or full disk	Satin to mirror
Brass	Lime soap or white lime	Sheepskin, felt or spiral sewed	Clear brilliant surface
Brass	Grease stick	Loose, or spiral sewed	Mirror
Brass	Tripoli 70	Full disk, or loose buff	Satin to mirror
Brass	Tripoli 70-100 (Hi-speed)	Full disk, or loose buff	Satin to mirror
Brass	Pumice-grease compound	Tampico, or horse hair	Satin or brushed finish; very little cutting down
Bronze	Tripoli 70	Full disk, or loose buff	High polish, easily rinsed
Cadmium	White coloring compound	Sewed canvas	Satin; use tripoli to buff or color
Cadmium	Pumice grease compound	Tampico or horse hair	Satin or brushed finish; very little cutting down
Cadmium	Grease stock	Loose, or spiral wheel	Mirror
Cadmium	Rouge	Looseor spiral wheel	Mirror
Cadmium	Lime soap or white lime	Sheepskin, felt, or spiral sewed	Clear brilliant surface
Copper plate	Lime soap or white lime	Sheepskin, felt, or spiral sewed	Clear brilliant surface
Copper	Grease stick	Loose, or spiral sewed	Mirror
Copper	Pumice grease compound	Tampico or horse hair	Satin or brushed finish; very little cutting down
Nickel plate	180-240 grit		Satin to mirror
Nickel plate	Limesoap or white lime	Sheepskin, felt or sewed spiral	Clear brilliant surface
Nickel silver	100 grit	Full disk or loose buff	High polish, easily rinsed
Silver	Tripoli 3-12 and crocus 100	Full disk, or loose buff	Satin, mirror, then high polish
Steel	Crocus, 10,000 ft min	Loose, or spira sewed	Mirror finish, easily cleaned and rinsed
Steel, Gear deburring		Tampico, or wire wheel	Cutting down and deburring
Steel, stainless	Rouge	Loose or spiral sewed	Mirror
Steel, stainless	Tallow, No. 1 operation 180 Al_2O_3	14-in. wheel, 1600 to 2600 rpm	Satin polish
Steel, stainless	Tallow No. 2 operation 220 emery	14-ir. wheel, 1600 to 2600 rpm	Satin polish
Steel, stainless	Dry compound	Revolve wheel in opposite direction of polishing, 18-in. hard wheel	Mirror No. 7.finish 2800 to 3000 rpm
Steel, stainless	Artificial flour mixed with grease	Loose, or spiral sewed	Satin, removes wheel marks
Steel, stainless	36 grit rubber bonded		
Zinc die casting	Greaseless, glue and cement, 180 grain	Solid, or build-up canvas felt or leather	No. 0 bright to semi-bright
Zinc die casting	Grease, stick-stearic acid or tallow, (etc.)	Loose or sewed pocket buff, or 18 to 20 ply pieced buff	To obtain mirror finish buff with No. 220 grain
Zinc die casting	Greaseless	Full disk, loose or set-up wheel, 12 in. to 18-in., wheel 8500 rpm	High quality coloring
Zinc die casting	(Slow medium) tripoli 20	Full disk, loose or set-up wheel	Satin or mirror
Zinc die casting	(Hi-speed) automatic tripoli 14	Full disk, loose or set-up wheel	Satin or mirror
Tin	Lime soap or white lime	Sheepskin, felt or spiral sewed	High polish, easily cleaned and rinsed

In general polishing speeds approximate 6500 fpm with final finishing or buffing operating at higher speeds of around 10,000 fpm. Initial polishing or cutting-down is effected with emery or tripoli generally, and final finishing with direction of finishing in opposite direction to polishing. Final finishing is done with such material as rouge (on precious metals), crocus for tin and iron, lime for nickel and copper alloys, chrome oxide for chrome plate, etc.

Emery grit is sized 6-200 mesh and finer 0,00,000,0000.

In connection with buffing, some metal is lost which must be kept in mind when buffing plated goods; for instance, 20 pct of the metal is lost in buffing nickel plate.

Buffing anodized and dyed aluminum removes approximately 0.00017 in., using rag buffs at 7500 to 9700 fpm. Flannel may be used for color buffing of gold, sand and oil hobbing (not emery) for silver, polishing at 6500 to 10,000 fpm.

TABLE XV

OPERATION COMPARISONS OF POLISHING AND BUFFING WHEELS

Factor	Spiral Sewed	Concentric Sewed	Square Sewed	Sewed and Pieced	Woven Cloth	Soft Canvas	Walrus Hide	Sheepskin, Felt, Irregular Shapes	Full Sewed Disk
Operation	More effective in cutting-down than disk wheels	More uniform results than with spiral-sewed wheels	For heavy cutting-down	For cutting down, low cost wheel	Polishing brass, stainless, aluminum, bronze and rough steel castings	For heavy aluminum and brass	Polishing cutlery, silverware, High-carbon steels	Fine buffing of flatware, cutlery, etc.	Performance almost equal to spiral-sewed in effectiveness of cutting-down

Leather-covered wood wheels perform like grinding operations.
Walrus leather disk, full disk sheepskin for brass, steel cutlery.
Canvas disk, coarse abrasive polishing-out on castings, forgings and brass plumbing.
Cloth or canvas most used and most versatile for roughing-out to finishing.

to copper and brass but not to steel or iron or aluminum.

Dimensional Change: Paint and lacquer coats usually exceed 0.001 in. thickness; 0.002-in. films may be expected for triple coats. Decorative plating approximates 0.001-in. deposits. Anodic oxide films on aluminum and magnesium may be controlled to zero dimensional change, and as a commercial maximum it may be expected not to exceed 0.0003 in. Though the actual aluminum oxide thickness may be from 0.0002 in. to 0.0008 in. dependent on the alloy and the anodizing time, but one third of the film thickness is actually an added dimension, i.e., the one third accounts for the oxygen addition to the basis metal surface.

Emissivity (Rate of Heat Transfer to Air): Aluminum, even more than copper, has high emissivity though its anodic oxide film somewhat lowers this factor.

Table VI compares the frictional factors of some metals. Aluminum has the poorest coefficient of friction, so apparently aluminum should offer no utility as a bearing surface. The anodic oxide film created on aluminum, however, has excellent capillary attraction for oil, waxes and graphite which act as lubricating films. Anodized aluminum pistons in internal combustion engines are used due to this oil-retaining characteristic. Hard, thick, porous deposits of chromium also serve to retain oil and the porosity coupled with its hardness, low coefficient of friction and lessened surface area present excellent bearing properties. Indium plated on iron or steel (and diffused into the iron or steel at about 350°F) serves effectively as a bearing surface. In the case of non-lubricated sliding action, deposits of well honed or buffed chromium, brass and waxed or graphite-impregnated anodized aluminum may serve for bearing surfaces under light loads.

Food Toxicity: Silver, tin, chromium, nickel, aluminum and anodized aluminum are non-toxic, as are stainless steel and Monel metal.

Heat Resistance: Organic finishes have relatively low heat resistances as compared to electrodeposits. For exposures to open flame or to elevated temperatures, deposits of chromium, nickel-chromium, copper, nickel and anodic films on aluminum are satisfactory.

Lifting and Peeling of Deposits: Table XVIII compares the ductilities and percentages of elongation of electrodeposits. These factors are a measure of the ability of a deposit to resist bending stresses which cause lifting and peeling. Anodic oxide films on aluminum and magnesium have superior resistance to lifting and peeling actions; in fact the anodic oxide films cannot, in the ordinary sense, be separated from the basis metal by mechanical or physical action. Paints and lacquers vary in their resistances to lifting and peeling; specific data on the subject are contained in the tables referring to paints and lacquers.

Nitriding and Carburizing Steel Alloys: In masking-out areas not to be surface heat treated, tin and copper deposits are usually used.

Reflectivity (Specular and Diffused): Table XVIII lists the comparative specular (bright) reflective values of electrodeposits. It is claimed that certain proprietary white-alloy deposits have high (78 to 82 pct) reflective values and relatively high corrosion and tarnish resistances. Though freshly deposited silver is the highest in reflective value, it tarnishes too rapidly for commercial reflector surfaces. Anodized aluminum surfaces may be processed to serve for either a specular or diffused reflective surface. Anodized aluminum rates next to gold as a reflective surface for infra-red energy. Rhodium over nickel or over palladium retains a high reflective finish, hence its use on searchlight reflectors and on jewelry.

Rubber Adherence: Brass plated on steel or on aluminum serves as an

TABLE XVI

TYPICAL POLISHING-WHEEL GRIT SIZES

Grit	Aluminum Die-Castings	Aluminum Sand-Castings	Aluminum Sheet	Brass Castings	Brass Sheets, Etc.	Cutlery	Gray Iron	Knives	Monel, Cast and Drawn	Monel Sheet	Enamel Stock	Stainless Steel Mirror	Commercial Steel	Zinc
Al_2O_3	150	36 to 46 60 to 80	120	60 to 80	180 to 220	80	70	80 to 90	80 to 120	180	90	60 to 80	80	180
Al_2O_3	x	120 to 180	180	150 to 180	Buff	120	120	120 to 150	120 to 150	x	100	120	100	220
Al_2O_3	x	x	Buff	220	x	x	150	220	150 to 180	x	120	150	120	x
Al_2O_3	x	x	x	x	x	x	240	x	Buff	x	150	Buff	180	x

TABLE XVII

SCRATCH BRUSH OPERATIONS FOR THE REMOVAL OF BURRS AND SCALE

Factors	Pipe Ends ID	Steel Tubes	Sheet Metal	Aluminum Castings	Aluminum, (Rough) Coarse Finishing	Aluminum, Fine Finishing
Wire size	0.14 in.	0.14 in.	0.095 in.	0.08 to 0.0118 in.	0.015 in.	0.002 to 0.005 in.
Wheel size	Small	8 in.	8 in.	2 to 12 in.	12 in.	12 in.
Arbor hole	⅜ in.	1¼ in.	½ in.	¼ to ½ in.	6 in.	6 in. or smaller
Rpm	20,000 fpm	30,000	3000	1750	1750	450 to 700
Operation	Deburring	Deburring	Deburring	Deburring	Cutting-down	Smoothing

For scratch-brushing aluminum and brass use soft brass wire with lanolin emulsion or soluble oil as a lubricant; for zinc and cadmium use scratch brush with 0.003 to 0.009 in. wire at 3000 to 6000 rpm. Steel wire presents more lustrous finishes on aluminum than does brass wire.

excellent film for the adherence of vulcanized rubber for vibration and shock absorption shear pads.

Solderability and Brazability and Weldability: Tin, proprietary white-alloy deposits, brass, cadmium and copper respond, in about the order named, to joining operations with low-temperature solders. Silver and copper are the usual surfaces used for brazing operations. Aluminum may be soldered with ordinary solders following the plating of any of the above named deposits. Aluminum is also soldered, at about 950° to 1000°F, by the use of proprietary fluxes and eutectic alloys. Aluminum may be brazed using special brazing sheet or rod with prepared fluxes. While the

TABLE XVIII PHYSICAL CHARACTERISTICS OF ELECTRODEPOSITED COATS

(* Relative values: A as highest comparative value with declining values depicted down to D.)

Deposits	Porosity	Hardness, Bhn	*Ductility	Tensile Strength, Psi; Also Pct Elongation	*Buff-ability	Pct Reflectivity (Buffed, Nearest Color)	Electric Conductivity Pct I.C.S.	Rate of Deposition (Min. to Deposit 0.0003 In.)
AN-QQ-A-696a Aluminum Oxide (Anodic)	A	700 to 800	A	5 pct less than basis metal	B	60 to 78 pct	0 (dielectric)	20 min. (average)
Brass	C	42 to 79	B	30,000 at 50 pct to 37,000 at 40 pct	A	55 to 60 pct, about equal to pale-green	26 to 43	Varies widely
Cadmium[1,3]	B	12 to 22	B	13,000 at 44 pct	C	85 pct, ivory	24	10 min at 20 amp per sq ft (tank); 30 min (barrel)
Chromium[1]	C	400 to 950	E	——	C	60 to 66 pct, sky-blue	13	18 min at 400 amp per sq ft; 2½ min at 200 amp per sq ft or 5 min at 100 amp per sq ft
Copper (cyanide bath)	C	130 to 160	B	12,000 at 35 pct to 50,000 at 5 pct	B	55 pct, pale-green	100	17.4 min at 15 amp per sq ft for 0.0003 in.
Copper (Rochelle bath)	C	130 to 160	B	12,000 at 35 pct to 50,000 at 5 pct	B	55 pct, pale-green	100	140° F, 6.6 min at 60 amp per sq ft; 11 min at 20 amp per sq ft (anode area twice cathode)
Copper (acid sulphate)	D	40 to 62	B	10,000 at 40 pct to 40,000 at 3 pct	B	55 pct, pale-green	100	8 to 21 min
Copper (bright bath, proprietary)	B	130 to 160	B	15,000 at 40 pct to 55,000 at 5 pct	A	55 pct, pale-green	100	6 min
Cerronizing (proprietary)	A	200	B	——	D	Low	—	Generally operated 2 hr
Gold	A	25 to 30	A	13,000 at 45 to 70 pct	A	78 pct, canary yellow	70	12 min at 20 amp per sq ft usual deposits 0.00075 in.
Nickel (hard bath)	A	450	E	170,000 at 3 pct	C	55 pct, pale-green	16	8 min at 100 amp per sq ft; 15 min at 50 amp per sq ft
Nickel (sulphate bath)[1]	D	125 to 175	D	50,000 at 30 pct	C	55 pct, pale-green	16	100 min at 50 amp per sq ft
Nickel (all chloride, proprietary)[1]	A-B	220	C-D	100,000 at 30 pct	B	55 pct, pale-green	16	8 min at 50 amp per sq ft
Nickel (hot Wattes bath)[1]	C	125 to 175	C	50,000 at 30 pct	C	55 pct, pale-green	16	10 min at 50 amp per sq ft
Nickel (bright baths, proprietary)	A	300	C	30,000 at 35 pct	A	55 pct, pale-green	16	10 min at 50 amp per sq ft
Platinum	A	600 to 645	A	45,000 at 90 pct	A	78 pct, ivory	15	30 to 60 sec. usually deposits 0.000001 in.
Rhodium	A	590 to 640	A	50 pct	A	78 pct, ivory	45	5 sec. for 0.000001 in.
Silver (cyanide)	A	60 to 79	A	30,000 at 50 pct	A	85 to 95 pct white	103	9 min at 30 amp per sq ft
Tin (stannate)	D	8 to 9	D	——	B	82 pct, ivory	14	30 min at 25 amp per sq ft; 0.00075 in. usual thickness deposited
Zinc (cyanide bath)[1,2]	C	40 to 60	A	17,000 at 17 pct	B	74 pct, canary yellow	28	11.4 min at 25 amp per sq ft; 5 min at 75 amp per sq ft

[1] U. S. Army specification 57-O-C lists requirements for cadmium, zinc, nickel, chromium, lead deposits as well as phosphate and black-oxide coatings.
[2] Army and Navy specification AN-P-32-Rev. 2 lists the requirements for zinc.
[3] Army and Navy specification AN-QQ-P-421A lists the requirements for cadmium.

weldability of the ferrous metals is well recognized, there have been difficulties with aluminum and magnesium until recently; multi-arc welding of aluminum and its vibratory welding enable thin gages to be welded and castings to be readily repaired. The Heliarc welding of magnesium is very effective. Soldered or brazed assemblies may present no difficulties in plating operations, or the joint area may interfere with ordinary procedures. No soldered or brazed assembly may be processed in anodizing baths. Fluxes must be neu-

TABLE XIX

PHYSICAL CONTROL OF PLATING BATHS

(S=suggested; R=required; No= Not Necessary. Throwing Po wer or Covering Power Implies Relative Uniformity of Depqsits in Recesse s, etc.)

Plating Baths	Typical Formulas of Electrolytes, Per Gal of Water	pH	Volts	Current Density Per Sq F t	Temperature, °F	Filtration	Agitation	Throwing Power	Usual Tank Material and Anodes
Brass	4 oz copper cyanide 1¼ oz zinc cyanide 7½ oz sodium cyanide 4 oz sodium carbonate Arsenic brightener or alum if desired	11.5 13.6	2 to 3	3 to 5	90 to 100	S	S	B	Steel; brass
Cadmium	3½ oz cadmium oxide 14.5 oz sodium cyanide 2 to 8 oz sodium carbonate Brightener as required	13	(still) 1.0 to 4.0 (barrel) 7 to 14	(still) 15 to 45 (barrel) 5 to 25	70 to 95	No	No	B	Steel; Cd
Chromium	33 or 53 oz chromic acid 0.33 or 0.53 oz sulphuric acid—1 gal water Anode-cathode distance 3 in.	Not controlled	4 to 12	100 to 1000, average 130 to 400	100 to 140	No	No S for hard chromium	F	Tellurium; lead; 7 pct tin-lead
Copper (cyanide)	3.0 oz copper cyanide 2.0 oz sodium cyanide 4.5 sodium carbonate with brighteners such as arsenic if desired	12 to 13	1.5 to 2.0 (warm solution)	2.5 to 1.5	75 to 100	S	No	B	Steel; rolled annealed copper
Copper (Rochelle)	3 to 6 oz copper cyanide 3 to 7 oz sodium cyanide 3 to 8 oz rochelle salts 2 to 8 oz sodium carbonate	12.2 12.8	2 to 3	20 to 60	140 to 160	S	S (gentle)	B	Rubber lined; copper
Copper (acid)	27 oz copper sulphate 6.5 oz sulphuric acid Addition agents such as glue or dextrose or others if desired	Not controlled	¾ to 2	15 to 40	75 to 120	S	Harder copper deposits require air agitation	C	Lead (6 lb) rolled annealed; copper
Gold	¼ to ½ troy oz gold as potassium gold cyanide 0.3 to 0.5 oz potassium cyanide 0.5 oz sodium diphosphate	Not controlled	2 to 5	2 to 10	14 to 160	No	No	A	Ceramic or rubber; gold
Nickel (hard)	5 oz nickel as nickel sulphate 4 oz ammonium chloride 4 oz boric acid	5.5 5.9 critical	4 to 6	25 to 100	120 to 140	R	R (mechanical)	D	Rubber; nickel
Nickel (all chloride)	40 oz nickel chloride 4 oz boric acid	2.0	0.5	50 (20 to 100)	120 to 150	R	R (mechanical)	D	Rubber; nickel
Nickel (sulphate)	Still bath: 16 oz nickel sulphate 3 oz ammonium chloride 3 to 5 oz boric acid (barrel: 20 oz, 4 oz, and 4 oz respectively) Hydrogen peroxide as required	4 to 5.8	1.5 to 2	5 to 15 or 25 to 40 agitated	Room temperature or 75° to 90° F	R	R (mechanical)	D	Acid brick, etc.; nickel
Nickel (Watts)	32 to 48 oz nickel sulphate 6 to 9 oz nickel chloride 4 to 6 oz boric acid	1.5 to 3 or 4.5 to 5.0	1 to 6 6 to 12	15 to 50	120 to 160	R	R	D	Rubber; lead; nickel
Nickel (Watts) and bright types	32 to 48 oz nickel sulphate 5 to 5.5 oz boric acid 4 to 6 oz nickel chloride Brighteners	5.2 to 5.8 (colorinitric); 3 to 4 in bright nickels	1 to 3	30 to 80	120 to 160	R	R (mechanical)	D	Rubber; nickel
Rhodium	2 g rhodium 20 cc sulphuric acid or 10 to 40 cc of 85 pct phosphoric acid	5.2 to 5.8 (colorinitric); 3 to 4 in bright nickels	2 to 5	10 to 80	90 to 120	No	No	A	Rubber; platinum
Silver	3 to 4 troy oz silver 4 to 6 oz free cyanide 4 to 12 oz potassium carbonate ⅛ fluid oz carbon sulfide	5.2 to 5.8 (colorinitric); 3 to 4 in bright nickels	less than 1 to 4	5 to 15	80 to 90	S	S	A	Rubber or ceramics; fine silver
Tin (stannate sodium)	(Still—barrel) 16 to 20 oz sodium stannate 1.5 to 2.0 oz caustic soda 2 to 3 oz sodium acetate 1/16 oz hydrogen peroxide		(still) 4 to 6; (barrel) 6 or more	(still) 5 to 25; (barrel) 3 to 10	146 to 176 160 to 180	No	No	A	Steel; tin
Zinc (cyanide)	8 oz zinc cyanide 7 oz caustic soda 3 oz sodium cyanide	12.2 to 12.7	1.5 to 6; (barrel) 10 to 15	10 to 20	105 to 120	R	S	B	Steel; zinc
Zinc (acid)	35 oz zinc sulphate 2 to 4 oz ammonium chloride 4 oz aluminum sulphate 12 oz glue	3.5 to 4.6 (still) 5.0 to 5.3 (barrel)	1 to 6	50 to 100 agitated	Room temperature	No	S	D	Lead or rubber; zinc

tralized prior to anodizing aluminum.

Staining of Deposits: Anodizing of aluminum prevents soiling of the hands which otherwise results when handling untreated aluminum. The products of steel corrosion often bleed through heavy nickel-chromium plate under severe exposure conditions, as is noticeable on automobile trim. (Trim and bumpers are usually coated with 0.0005 in. of copper and 0.0005 in. of nickel and 0.00002 in. of chromium). Brass, copper, cadmium, silver and zinc, unless lacquered or surface treated, may stain wood, masonry, cloth and the skin. Aluminum when used as the basis metal produces no discoloration products of corrosion to bleed through electroplates or through anodic oxide films.

Anodic oxide films on aluminum and its alloys are the only type of deposit which presents the following list of characteristics:

(1) It retains its natural finish.

(2) It will not stain fabrics, skin or building materials.

(3) The products of corrosion of aluminum are colorless and will not bleed through the anodic film to cause surface stains or discolorations.

(4) The film formed by anodizing aluminum is the only commercial decorative surface which cannot be lifted or peeled.

(5) The anodic oxide film on aluminum is the only decorative surface which is electrolytically protective to the basis metal. (Cadmium and zinc are electrolytically protective to steel and aluminum, but these deposits are not ordinarily considered as decorative finishes.)

(6) The anodic oxide film on aluminum (and to a lesser degree on magnesium) is the only film on metals which accepts dye colors to form true color lakes just as occurs in cloth dyeing operations.

(7) The anodic oxide films (on alu-

TABLE XX

TYPICAL SOLUTIONS FOR STRIPPING ELECTRODEPOSITED COATS

Plate or Coat to be Stripped	Basis Metal or Alloy From Which Coat or Plate is to be Stripped				
	Aluminum	Brass or Copper	Nickel or Nickel-Silver	Steel	Zinc
Aluminum oxide anodic and chemical oxide coats	Hot caustic solution etch badly; several proprietary solutions remove oxide with controlled etch	X	X	X	X
Brass	50 pct nitric acid at room temperature	See pickling and brightener tables VIIIA and VIIIB	Same as on Steel	Reverse current in hot caustic soda solutions, 6 v at room temperature	50 pct sulphuric acid at room temperature or reverse current in a sodium cyanide solution
Chromium	X	Same as on steel, or 1 pt HCl and 1 gal H_2O at 125° F, or concentrated HCl at room temperature	Same as on steel	Reverse current in hot caustic soda solutions, 6 v at room temperature; or reverse current in a sodium sulfide solution.	
Copper	50 pct nitric acid at room temperature	X	Same as on steel	(1) Concentrated nitric acid; or (2) 1 lb polysulfide, 1 gal water, rinse and dip in 6 to 9 oz sodium cyanide, 1 gal water solution; (3) 3 lb liver of sulfur, 1 gal water	Chromic acid and ½ pct sulfuric acid removes 0.001 in. in 20 mins at 212° F; reactivate the zinc in dilute hydrochloric acid
Gold	6 volumes sulphuric, 1 volume water at 6 v; copper cathode; dip in 10 pct sodium cyanide to brighten	Same as on aluminum, or 6 volumes sulfuric and 1/10 volumes lactic acids.	Ammonium per sulfide at room temperature; or 4 oz sodium cyanide, ½ to 2 oz caustic soda, 1 gal water. Anodic, 1 v at 100° F, agitate	4 oz concentrated hydrochloric acid, and 1 fluid oz glycerine, 1 gal water, cathodic at 6 v	Same as on steel
Lead or solder	50 pct nitric acid for regular aluminum solders	Same as on steel	Same as on steel	16 oz caustic soda, 1 gal water; anodic at 180° F to 190° F	X
Nickel	50 to 75 pct nitric acid	Same as on steel	X	1 volume concentrated nitric acid at 80° to 90° F removes 0.001 in. in 20 min, or reverse current in (56° Be) sulfuric acid	Reverse current, 2 pct sulfuric acid, 10 to 30 amp per sq ft; glycerine may be added
Platinum	X	X	Same as on steel	In contact with iron in hydrochloric acid; also in aqua regia	X
Rhodium	X	Same as on steel	Same as on steel	Molten sodium cyanide; or reverse current in a hydrochloric acid solution	X
Silver	50 pct nitric acid	Same as on aluminum	Same as on aluminum	Anodic in 12 oz NaCn, 2 oz NaoH, and 1 gal water; 6 v at room temperature, steel cathode	Same as on steel
Tin	50 pct nitric acid	2 oz antimony trioxide, 1 gal water; or same as steel	X	Reverse current, 40 to 60 amp per sq ft in an alkaline solution; or same as silver from steel	X
Zinc or cadmium	50 pct nitric acid	Reverse current in a caustic soda solution	X	Reverse current in a caustic soda solution; for cadmium 1 gal hydrochloric, 2 oz antimony chloride, 1 pt water, room temperature, remove smut in solution of 1 lb ammonium nitrate, 1 gal water, room temperature	See pickling and brighteners table VIII-A

A number of proprietary stripping solutions are offered which may have added efficiency as compared to the above solutions.

minum and magnesium) are the only electrodeposited films which are nonconductive to electricity, though aluminum itself in commercial purity is only second to copper as an electric conductor.

(8) The films produced by the anodic treatment of aluminum are the only deposited coats, other than porous chromium, which have capillary attraction for oils, waxes, paints, lacquers and other fluid materials and colloidal substances.

(9) By the assembly of different types of aluminum alloys two-tone dye coloring effects may be obtained. Scratch-brushing also enables two-tone effects to be attained.

(10) The anodic baths for treating aluminum presents nearly ideal conditions as to covering ability as compared to plating baths.

Salvage and Build-Up: Nickel, copper and chromium are the electrodeposits usually used to build up worn or over-machined steel and aluminum parts.

Throwing (covering) power signifies the ability of an electrolytic bath to plate into recesses and to coat surfaces not in line with the anodes. Table XIX presents the comparative throwing-power values of electrolytes. The aluminum anodizing baths give by far the best throwing-power or covering ability and chromium plating electrolytes are the poorest in this respect.

The throwing-power factor may under some circumstances change the finishing selection aspect particularly on intricate parts and assemblies.

Cost Factors in Finishing: Table XVIII lists the deposition rates of electrodeposits, and tables XXII and XXIII indicate the timing in the surface treatments of aluminum and magnesium. The time in treatment baths, however, is but one item in the cost of finishing. Comparative cost factors vary too much to afford the opportunity of even generalizing without danger of making misleading statements. For instance, though cadmium metal costs about six times as much as zinc, cadmium is the preferred deposit by a ratio of about 3 to 1. This popularity is due in part to its greater covering ability. In the decorative finishing of intricate shapes the anodic dye coloring of aluminum may be more practical than chrome plating due to the superior covering ability of the anodic process.

Polishing and Buffing Costs: Cast iron requires grinding in addition to polishing and buffing, which ranges from 30 pct to 40 pct of the finishing cost; steel will approximate 10 pct less; aluminum, brass and diecast zinc will generally be 10 pct under steel in polishing and buffing costs.

Barrel Plating: When the shape of the work permits, barrel plating is far less expensive than still-tank plating. Neither aluminum nor magnesium may be anodized in barrel operations.

Die Castings: Zinc, aluminum and magnesium alloys, in the order named, are the usual die castings. Some zinc die castings and all aluminum die castings must be given a pre-treatment, as shown in table XXII, prior to electroplating. Zinc die castings may be blackened (see table XXV), and they must be treated as noted in this chart prior to lacquering. Aluminum and magnesium require pretreatments prior to organic finishing. Aluminum die castings containing silicon do not accept pleasing bright colors from the dye baths subsequent to anodizing, though they may be dyed black.

Extrusions: Aluminum, brass, copper and zinc are the popular metals for extrusions and moldings. These metals may be plated or lacquered following surface treatments. Aluminum may be electroplated by proprietary processes, or anodized to (1) simulate antique or butler-silver finishes, (2) dyed to simulate gold in any desired tone, (3) pastel shades, (4) deep shades and (5) blacks; these colors may be produced with a flat effect, semi-gloss or with a high-gloss finish. The high-gloss dyed finishes present an iridescent (Dresden China sheen) brilliancy. The dyed aluminum finishes offer particularly harmonious effects for assembly with glass, wood and plastics.

Permanent Molding: In aluminum and magnesium is gaining in popularity, and their finishing follows the requirements as noted in tables XXII and XXIII.

Spinnings: Aluminum, copper, brass and zinc, in the order named as to predominance and economics, are used for reflectors and similar applications. Special treatments prior to anodizing, and deposits of reflective metals or alloys on aluminum are standard finishes. Brass and zinc spinnings are generally plated, though brass spinnings are also clear lacquered.

Racking-up Costs: May involve a consequential percentage of the finishing costs. In some cases, where no consideration has been given in the design of an article for a means of racking, discernible racking-up marks may lower the whole appearance of the finished article.

After the first model is completed, and before final styling and finishing has been decided upon, reliable finishing firms should be consulted for opinions.

Relation of Finishing Costs to Cost of Production: The finishing costs of a product may be 10 pct to 50 pct or more of its production costs. For large articles such as electrical refrigerators, washing machines and electrical ranges, finishing costs are about 11 pct to 17 pct of their production costs.

Less bulky articles, as for example toasters and electric irons, have about 20 pct, novelty ware 25 to 30 pct and costume jewelry 20 to 50 pct or more for the finishing proportion of their production costs.

Effect of Surface Finish on Electroplated Coatings

TO determine whether the finish of steel prior to electroplating effects the protective value of plated coatings, the American Electroplaters' Society in cooperation with the National Bureau of Standards investigated the polishing and plating of cold-rolled steel and noted the effects of exposure of the specimens to the atmosphere. Results of this project have been published under the title "Methods of Polishing Steel and their Effects upon the Protective Value of Electroplated Coatings."

Strips of a special SAE 1010 steel having a cold-rolled No. 3 finish and a No. 3 temper were polished with wheels to which abrasives of different grain size were glued. The resultant finishes were measured with a Profilometer and were expressed as root mean squares in microinches of the departure of the contours from a plane surface. The finishes varied from a superfinish with an rms of less than 1 m in. to one of 65 m. in., produced with a 90-grain abrasive.

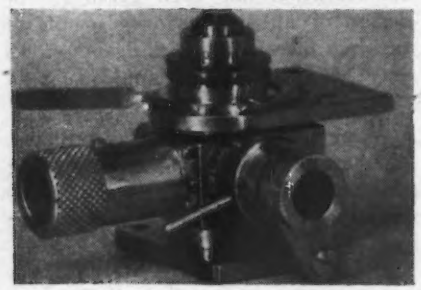
The polished specimens were plated with copper, nickel and chromium of controlled thickness and were exposed to the atmosphere at New York, Sandy Hook and Washington. The extent of rusting observed at periodic inspections revealed no conclusive evidence of a consistent effect of polishing upon the protective value of plated coatings on cold-rolled steel. Nor did wide differences in surface finish of the steel significantly affect the protective value.

New Equipment

Plant Service

. . . Recent improvements in accessories for the metal working shop are described herein.

ZINC sulfide film for coating the clear glass vertical illuminator plate of their illuminating units is said to double the efficiency of these units according to an announcement



by *Bausch & Lomb Optical Co.*, Rochester, N. Y. The coating provides twice as much light in the image which is said to cut the photographic exposure time in half. This improvement is especially valuable for high magnifications and for specimens of low reflecting power which require long exposures. Only about 2½ millionths of an inch thick, one fourth the thickness of a wavelength of light, the coating works on the principle of the interference of light waves. A new way of utilizing films for either increasing or decreasing reflection and transmission of lenses and prisms has also been announced. If the film is made with a refractive index lower than that of the glass, more light goes through the glass and less is reflected. On the other hand, if the index of refraction of the film is greater than that of the glass, less light goes through the glass and reflectance is increased. In the metallographic equipment mentioned above, rays from the light source are reflected by the vertical illuminator plant onto the specimen and back through the transparent illuminator plate to the eyepiece and camera. Therefore, any increase in the amount of light reflected by the transparent plate onto the specimen results in an increase of light as the eyepiece and photo negative.

Shock Absorbing Lamps

A HIGH impact, shock absorbing lamp has been developed by *General Electric Lamp Dept.* at Nela Park, Cleveland. Except for a thick band of rubber surrounding the neck of the bulb, the lamp resembles the ordinary household lamp. The remainder of the heat and shock resist-

ing rubber skirted insert is located between the lamp's medium screw brass base and the bulb's glass neck. Laboratory tests are said to show that the rubber cushioned lamp can withstand shocks of 2000 ft-lb.

Fluorescent Lampholder

CALLED the twin turret, a fluorescent lampholder made for use with 40-w lamps has been announced by *General Electric Co.*, Bridgeport, Conn. The lampholder, which has a metal casing with an insulated face, holds two Mazda F fluorescent lamps. Starter sockets are an integral part of the lampholder and are located between the lamps. They will accommodate either FS-40 G-E watch dog starters or conventional FS-4 starters. Tinned and stripped leads can be inserted through entrance holes in the face of the lampholder. Binding screw can then be tightened through the holes in the bottom of the lampholder to make permanent pressure contacts.

Flexible Stainless Hose

FOR applications where flexible connections are required between movable parts or where vibrations are set up between two rigidly held units, flexible stainless hose has been developed by *Carpenter Steel Co., Welded Alloy Tube Div.*, Kenilworth, N. J. The hose can also be used for flexible steam connections, for flexible conduits for wiring and for intricate connections on lines carrying corrosive liquids.

Mousing Tool

A MOUSING tool for dead-ending guy strands has been developed by *Copperweld Steel Co.*,

Glassport, Pa. Together with a coil of annealed wire, the tool is said to enable the lineman to place about 50 closely wrapped turns around the free end of the strand and the main strand, thus binding them closely together.

Spray Booths

A LINE of spray booths and wet dust collecting equipment designed to handle metal spray dust has been announced by *Metallizing Engineering Co.*, Long Island City 1, N. Y. The line includes spray booths for exhausting to present exhaust systems, to the atmosphere or into a Metco wet collector. A lathe exhaust unit which is mounted directly on the lathe carriage and moves with it is featured as are wet collectors and water wash spray booths which gather metal particles into a sludge sump where dust can be reclaimed for salvage. Other features of the booth are sloping rear wall, open type work table, down draft, dust trap and cleanout door.

Metal Coating Stick

FOR replacing damaged metal coating brought about during the process of butt welding the wire ropes, a coating stick, AMCO, has been announced by *American Solder & Flux Co.*, Philadelphia 25, Pa. Brand A is a pure tin coating, Brand B a tin and lead combination, Brand C, a lead coating, Brand E, a zinc coating. It is claimed that the coatings produced by the AMCO sticks are equivalent to the hot-dip process and that the galvanizing stick will protect metal surfaces equal to hot galvanized coatings.

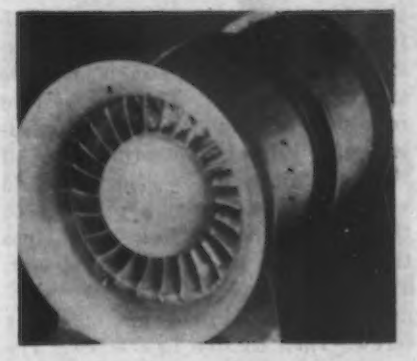
Strainer

DESIGNED for use with machine tools, a strainer, known as the Strainco-Metex Unit, has been announced by *Strainer Products Corp.*, 75-77 N. Willow St., Montclair, N. J. Strainer refills are said to be easily installed and old ones washed and ready for reuse in a matter of minutes. The units are said to be supplied in types, sizes, and capacities for every size and type of machine tool. The units are for installation

in the machine tool sump tank or in a separate tank on the pump intake.

Magnetic Separator

A HIGH intensity dual cross belt electro-magnetic separator designed to remove even the finest fuzz of iron non-ferrous borings and to reclaim abrasives from grinding wheels has been announced by *Dings Magnetic Separator Co.*, 509 E Smith St., Milwaukee 7. Material to be separated is loaded into a hopper, from which it is distributed uniformly onto the first main belt by a reciprocating feeder. When the material passes through the first and second magnetic zones, magnetic particles are lifted by the upper magnets and pushed up by the lower ones. In this way, they are held fast to the under surface of the first cross belt which carries them beyond the magnetic influence to be discharged at the side. The first main belt discharges onto the second main belt at which point the material is turned over. It is then subjected to another magnetic treatment in third and fourth magnetic zones.



Axial-Flow Compressor

A LINE of axial-flow compressors, blowers and fans have been announced by *Buffalo Turbine Corp.*, 2165 Bailey Avenue, Buffalo 11. Because of the high capacity and small size of many of these units, it has been necessary to develop special motors having exceptional high hp. and small diameters. The 14-in. diameter blower shown delivers 8000 cfm and 10 in. sp, turning 3450 rpm. It is driven by an 8-in. diam 20 hp motor. The complete unit weighs 130 lb.

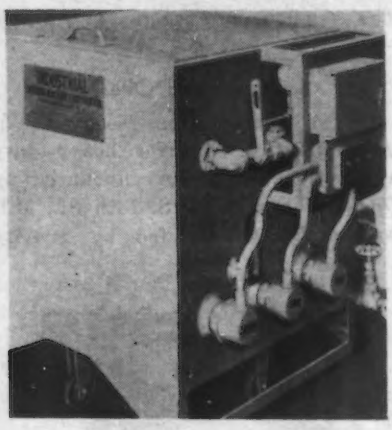
Drop Feed Oiler

AN adjustable drop feed oiler in miniature size for heavy duty applications has been announced by *Oil-Rite Corp.*, 3489 S. 13th St., Milwaukee 7. Oil is fed by gravity

through an oil port which can be adjusted within a wide range. An extremely slow drop feed is possible even with light oil. The rate of feed remains practically constant regardless of oil level. To adjust the oil flow, the hinge lid is held open and a standard hexagonal key is placed through the hollow lock screw into the set screw and adjusted to suit. To lock desired setting, partly withdraw key until it engages only lock screw. Then tighten lock screw. The combination of a hollow lock screw and a set screw provides a positive means of locking, retaining any desired setting even under vibration.

Portable Washing Machine

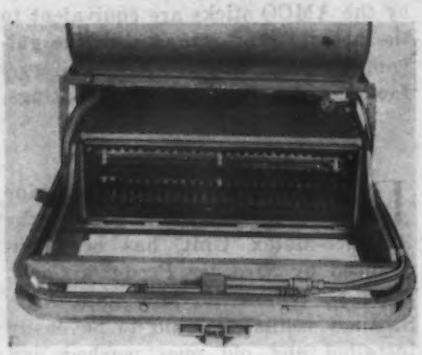
A PORTABLE industrial washing machine has been developed by *Industrial Washing Machine Corp.*, New Brunswick, N. J. Parts to be cleaned are placed in a square mesh basket 16 x 16 in., the cover is lowered



and the spray valve turned. The force of the spray causes the basket to rotate so that all of the material is cleaned. The basket can be removed and the machine converted into a dip tank which can be used for wax or oil dipping of parts.

Sweeping Unit

DESIGNED especially for cleaning out corners and close to the wall sections, the Moto-Sweeper, a blower with a flexible hose that blows the refuse and dirt right into the path of the revolving brush metal tubing attached has been announced by *Moto-Mower Co.*, 4600 Woodward Ave., Detroit 1. Other refinements include an improved method of laying the dust. Where before air was pumped into water tanks to produce a fine spray, it is now applied at the nozzle providing a more positive control which eliminates the necessity of building up undesirably high air pressures in the water tank.



Parts Cleaning Machine

A PORTABLE type parts cleaning machine has been announced by *Park Chemical Co.*, 8074 Military, Detroit 4. Large parts to be cleaned are placed in the tank and the cleaning solution is agitated by means of air pressure. The air is dispelled from a series of holes in a pipe which runs lengthwise at the bottom of the tank. Small parts such as screws, washers, etc., are placed in the round basket and soaked in the solution for a few minutes. The basket can be revolved and swished by hand. After the parts have been cleaned, the rack is placed on an attached drain-shelf which drains the solution back into the tank for reuse. Parts are then blown dry by means of the air gun and rinsed with water or petroleum spirits. For operation, it is merely necessary to attach the machine to the air-pressure line. Included as standard equipment are the basket, metal rack for the bottom of the tank, air agitator and air gun with 5 ft of hose. A cleaning solution, Tank-Solv, has been compounded for use with the machine. Of the non-evaporating type, the solution cleans by physical action allowing all grease and grime to settle to the bottom of the tank.

Molded Silastic Parts

MOLDED silastic parts—gaskets, seals, hose, rubber to metal adhesion and miscellaneous pieces have been announced by *Connecticut Hard Rubber Co.*, New Haven, Conn. Extreme heat resistance is said to be the outstanding physical characteristic of Silastic. The plastic is said to withstand temperatures from — 70° F to + 500° F and still retain its resilience and flexibility. Its dielectric properties, arc, corona and oxidation resistance are said to assure durability under hot service conditions.

Fire Extinguisher

A PORTABLE fire extinguisher, the Alfite Speedex, has been announced by *American-La France-Foamite Corp.*, Elmira, N. Y. The extinguisher is made in three different sizes, Models 15, 10 and 4 and uses carbon dioxide as the fire extinguisher agent. The numbers indicate the pound capacity of the gas. The operating valve lever is directly above the carrying handle. For continuous operation the D-yoke ring is slipped over the operating lever while it is depressed.

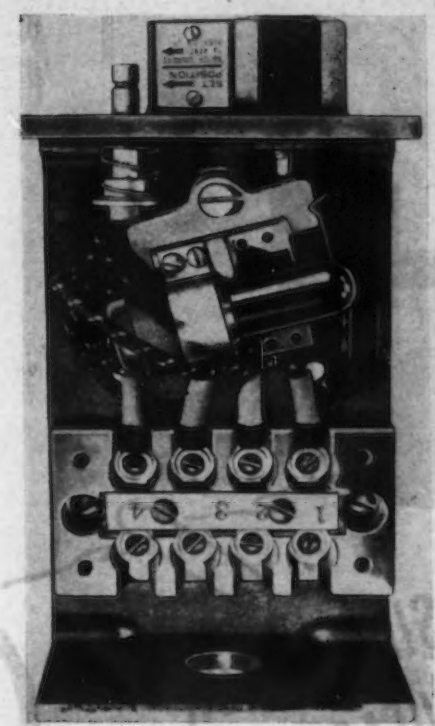
Benders

IMPROVEMENTS in their benders have been announced by *O'Neil-Irwin Mfg. Co.*, Minneapolis 15. Operating friction has been greatly re-

duced in the benders by the installation of Torrington roller bearings. An instantly reversible lever control cam permits the operator a choice of either right or left hand forming direction. The benders can be used on the job for all types of forming in all ductile materials including round, half round, square and hexagon rod, tubing, angle channel, molding strip stock and bus bar (formed both flat or edgewise.)

Pressure Switch

THE pressure switch, an accessory device, designed for use with built-in carbon dioxide fire extinguishing systems has been announced by *Walter Kidde & Co.*, Inc., 140 Cedar St., New York 6. It assists in isolating the fire by automatically cutting off electrical circuits in fans, blower or other electrical equipment when the extinguishing system operates. It is a self-contained, mercury, contact-type switch suitable for applications which employ gas or air pressure. The switch is connected by a bleed



pipe from the main distribution line and is operated by the carbon dioxide in passing through the distributing piping to the discharge nozzles. The gas pressure actuates a plunger which trips the breaker arm of the switch, opening or closing the circuits desired. The device is available for control of two, three or four circuits, each of which can be wired for normally open or normally closed operation. The switch is provided with a manual reset to restore circuits to their original position after operation.

Plastic Eyeshield

A PLASTIC eyeshield, the Featherspec, that weighs less than an ounce has been developed by *Wilson Products, Inc.*, for use in semi-hazardous jobs such as spot-welding, light grinding and woodworking. A one-piece plastic lens is gripped in a suspension lock frame but is interchangeable or replaceable in 10 sec. A slight pull releases the lens from the grooved metal frame and makes it possible to substitute a green lens for a clear lens if the work involves glare. The shield can be worn over prescription glasses.

Oil Mist Collector

A DEMOUNTABLE electronic unit designed to collect oil mist from high speed cutting tools or welding fumes in light concentrations has been announced by *American Air Filter Co.*, 215 Central Ave., Louisville 8, Ky. An axial flow fan mounted on top of the unit draws air from the operation, which is hooded, through piping or flexible tubing into the base of the unit. The mist-laden air first passes through a permanent unit filter to remove any metallic dust or large drops of oil and then enters the ionizer. Here the mist and smoke particles receive an electrical charge before passing into the collector unit where they are precipitated on the plates, pass through the filter and into a reservoir below. Features of the collector include a removable panel for full access to all parts, which are removable tools of any kind. Called Elec-

tro-Mist, the unit is made in one size, 28¾ x 20¾ x 70 in. high. The power pack operates from nominal 115 v, 60 cycle, single phase.

Lubrication Cart

FOR transporting and dispensing a variety of grades or types of lubricants, a Lubrikart has been announced by *Alemite Div., Stewart Warner Corp.*, Chicago. The unit comes in two models. The basic model carries two 7-gal tanks equipped with low pressure pumps with 5½-ft hose

and non-drip nozzles, one 7-gal tank with high pressure pump, two 1¾-gal tanks with oil transfer pumps, six spout-type oil cans and four lever-type handguns. The second model has a high-pressure, hand-operated grease pump which holds 30 lb of lubricant and 5½-ft lubricant hose fitted with a hydraulic coupler.

Goggle Station and Cleaner

A GOGGLE station and liquid goggle cleaner, the Sani-Spray, has been announced by *Allen Optical Co.*, Buffalo 2, N. Y. The station is a self-contained, steel atomizer cabinet designed especially for supplying the cleaner. The cabinet holds a quart jar of Sani-Spray, a supply of tissue paper and built-in receptacle for used cleaning tissues. Push-button control releases a fine mist of Sani-Spray from an orifice on one side of the cabinet.

Work Bench

A 12 gage steel work bench, the Equipto, has been announced by *Equipto Div., Aurora Equipment Co.*, Aurora, Ill. All four flanges are formed into a boxed edge. A second 12 gage steel plate can be tack welded onto the top for vise reinforcement. The bench is suitable for both work bench use and for supporting light machine tools. The four feet have holes to permit fastening to the floor if desired. The bench is available in 42 in. and 6 ft. lengths, 34 in. high and 28 in. deep. It can be furnished as plain work bench with 12 gage steel top and with bottom tray, back and side railings, drawers with padlock attachment and an adjustable 3 compartment fray for drawer.

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Assembly Line . . . STANLEY H. BRAMS

• Department of Labor study seeking to find most efficient work-week establishes that as hours pass the 40-to-48 level, efficiency declines and absenteeism increases.

DETROIT—A year ago, when there was considerably more furore over the length of the work-week than at present, the Dept. of Labor began to delve into the effect of lengthened or reduced hours on work efficiency, absenteeism, accident incidence and other production phases. Considerable of this work was done in Detroit and the midwest, and the first report—covering 12 metal working plants—is now available.

No hard and fast conclusions can be drawn, even though the surveys were very carefully worked out from the statistical standpoint. In all cases the plants under examination had fairly complete records under two substantially altered working schedules, each one maintained long enough to permit adequate measurement of results after a transitional period. At the same time, processes within the plant or department remained essentially the same and identical workers were largely involved, making good comparisons possible.

The companies or departments studied included a nonferrous metal foundry, the finishing department of a foundry, an upset forge plant, two parts plants, an engine manufacturing plant, a welding shop, a metal bearing plant, a cutting tool plant and a shell making plant. The results made it eminently clear that there is no such thing as an "optimum work-week" for all industry. A satisfactory schedule for a light machine shop would be wasteful in a foundry. Considerable difference was encountered in plants working under wage incentives and those working at straight time.

However, fairly rough correlation was noted in the findings, indicating that hours worked beyond 40 or 48 per week resulted in additional output, but only at the cost of continuous decreases in efficiency and marked increases in absenteeism. The survey, made by Max D. Kossoris of the Bureau of Labor Statistics, reported that, "a point is finally reached at which the longer work schedule is no more productive, and may actually be less productive, than a shorter work schedule. With few exceptions longer working time in the plants studied resulted in a general slowing down, not only during the added hours, but throughout the entire work-week."

As a general rule, a 7-day week was found uneconomic and actually resultful of less production in some instances than a 6-day week. Available evidence indicated that on the whole the 5-day week and 8-hr day are more efficient than work scheduled with longer hours, but the survey went on to add that there is little sacrifice of efficiency if a sixth day of eight hours or less is added.

The evidence seemed to show that the sharpest break in production comes for incentive-paid workers when daily hours are raised from eight to nine and one-half or more. On a 40 or 48-hr week schedule, efficiency builds up toward a peak on the third and fourth days of the week, with a slight drop thereafter; but when daily hours were lengthened to nine and one-half or more this peak disappeared, the production curve for successive days of the week flattened out, and the indication was, "that workers adjust themselves to longer hours by slowing down, not because they want to, but because they have to."

FOR workers on the second or night shift the pattern was somewhat different. Daily efficiency performance under an 8-hr day and 5-day week was fairly constant, without the mid-week bulge of the day shift. When a sixth day is added to stretch the week to 58 or 60 hr the result is likely to be a steady decline in the efficiency level day after day. These "fatigue

QUICK SHIFT: *Within a week from the time of war contract cancellations, these tank type units of a new vacuum cleaner design were in production on an assembly line basis.*

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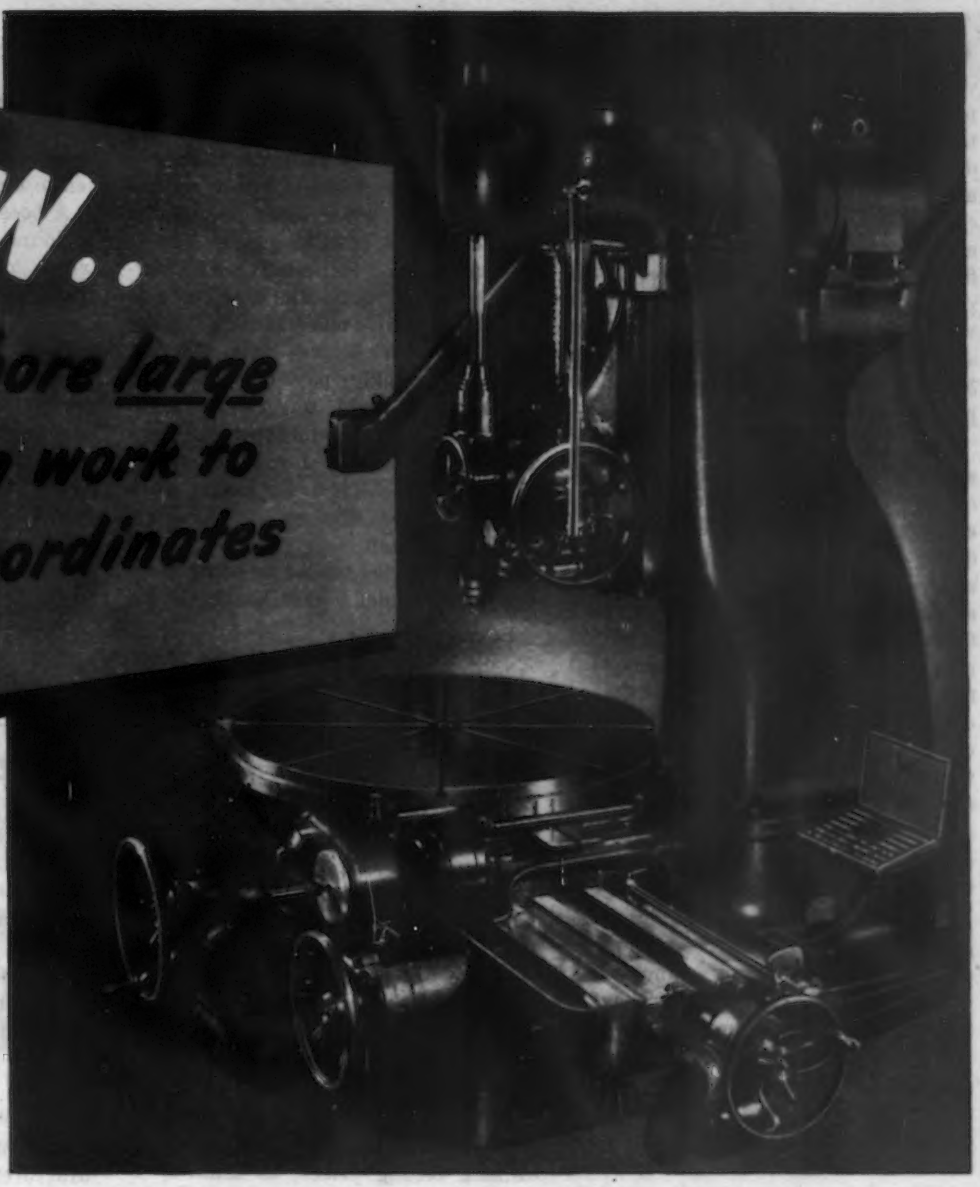
You can bore large precision work to polar co-ordinates



Here's a brand new feature on the Pratt & Whitney No. 3B Jig Borer . . . a really *big* precision rotary table, 48" in diameter, that is built right into the machine.

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On circular work, the average job can be done to excellent accuracy using only the precision worm indexing mechanism. For still closer accuracy, a spacing system may be incorporated in the outer table rim. Power traverse is provided on both slides and on the rotary table.

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patterns" make it possible to predict, the report stated, that a change in daily hours from eight to ten or from a 40-hr week to one of 50 hr for incentive wage workers was likely to cause a decrease in efficiency of about five pct; and then when this level was raised still higher by adding a sixth work day the decrease would be from seven to ten pct if hours do not exceed 58 or 60, and may rise as high as 20 pct if hours reach 66.

Interesting enough, for men on straight day work rates, lengthening or shortening of hours seems considerably less significant. In two foundries, daily scheduled hours remained at ten but the sixth day was dropped, and in the other, daily hours during a 6-day week were raised from eight to nine and one-half; and in each plant the hourly efficiency level remained essentially unchanged. The report concludes: "Apparently the pace at the shorter hours was not so fast that the addition of extra hours caused a slowing down; nor did the shortening of hours bring about any quickening of the work tempo."

In plants where work was light, the general tendency seemed to be for employees with weekly hours ranging between 55 and 58 to produce about a 2-hr volume of production for each three hours added above 48 per week, that is, six days of eight hr apiece. When work was heavy, as in foundries, the ratio was much more nearly one hour's additional output for each additional two hours' work, one reason being the greater need for rest pauses.

In a forge shop, where work was hot and heavy, a 52-hr week was found as productive as a 58-hr week. In a shell plant of excellent morale and medium heavy work, lengthening of daily hours from eight to ten for the day shift and 11 for the night shift and of weekly hours from 40 to 60 and 66 had such unsatisfactory results that the plant soon changed over to a 48-hr week. The average increase in output under the longer schedule was only about seven pct above that for the 40-hr week—a result which could have been achieved by increasing weekly hours from 40 to 43 or 44.

ONE plant operated extensively on Sundays under a 7-day weekly schedule, remaining on an 8-hr day. After a year's experience with this schedule, every third Sunday was dropped out, then every other Sunday and finally every Sunday. The efficiency was lowest during the 7-day week and highest during the 6-day week when no Sundays were worked at all. The data indicate that efficiency was about 36 pct better and total output 30 pct greater during the shortest work schedule.

Absenteeism increased with augmented hours. This was attributed to various factors—more illness, worker desire for more leisure time, the fact that the weekly pay envelope was larger and could underwrite additional leisure time, and others. Absenteeism was higher for night shifts than for day shifts under longer work schedules, and this was particularly true for women.

Work injuries tended to occur more frequently under longer hours, the report stated. In one plant they occurred only one-third as frequently when daily hours were reduced from ten to eight.

A boost for incentive wage systems is found in one phase of the report, which observes that in a foundry when a rate change was made from day work to piece work, increases in output were registered even when hours remained ten per day and 58 per week. When the incentive system combined with a reduction in weekly work days from six to five, during which the 10-hour day was maintained, output during the shorter work-week was 13 pct greater than it formerly had been under the 6-day week.

o o o

OPA Announces Price Regulation MPR 594 Governing New Passenger Cars

Washington

• • • Procedures to be followed by automobile manufacturers in calculating ceiling prices on new passenger cars, including a method for concerns planning to introduce new models—such as Kaiser, Graham-Paige and Crosley—were announced by OPA on Aug. 31.

The new price regulation MPR 594, effective Aug. 31, provides manufacturers with four methods for determining ceiling prices, as follows:

1. The first pricing method is for use in determining ceilings for new automobiles that are not substantially different from the makers' most similar 1942 models. Under this method, the ceiling price for the new passenger car to each class of purchaser is the producer's highest net price for the most similar 1942 model, except that additions for storage of 1942 models in connection with the rationing of those cars may not be added.

2. This is for cars with changes in specifications, design, material and equipment from their most similar 1942 model. For such cars the manufacturer's ceiling price is computed by adjusting the price calculated by the first method to reflect net increases or decreases in direct labor and material costs resulting from the changes.

3. This method may be used in calculating the ceiling price for any new passenger automobile. Under this method, ceiling price adjustments are based on costs in the last period of normal production, to which are added increases in basic wage rate schedules and in material costs, plus a normal peacetime margin of profit. The new pricing rules provide that the base costs to be used are those for 1941 models. This profit factor will be either a manufacturer's own 1936-39 margin or one-half the industrial average for the period, whichever is higher.

If the price computed according to this formula is higher than the manufacturers 1942 model price, this will become his new ceiling price. If it is below his 1942 price, that 1942 price will stand. In either case, it was pointed out, provision is made for substantial model changes resulting in net cost changes.

4. This method is used for establishing ceiling prices for makes of cars not previously manufactured, or for models of automobiles radically different from 1942 models of the same make. Manufacturers of cars in this category must apply to OPA for maximum prices.

Where the manufacturers' ceiling prices are calculated by methods 1 or 2, the resellers' maximum prices will reflect the same margin over cost as they received for the 1942 models.

In cases where manufacturers receive their ceilings under the third pricing method, OPA will determine —after a careful study of the facts and consultation with dealers—the ability of dealers and distributors to absorb any increases granted under this method.

When Carpenter made Stainless EASY TO MACHINE

Before Carpenter invented Free-Machining *Stainless* Steels, it was a difficult operation to produce any kind of *Stainless* parts from bar stock. Even the aircraft industry, small as it then was, had its difficulties trying to machine *Stainless* parts.

Today mass-production of *Stainless* parts for aircraft is commonplace. You marvel at the clean machining—the close tolerances—the high output—the low rate of rejects. Free-Machining *Stainless* Steels have made it possible for the aircraft industry to utilize the corrosion protection and weight saving advantages of this modern metal.

Carpenter Free-Machining *Stainless* Steel is serving in many vital spots in thousands of mass-produced planes. The carburetor part shown above is just one example of the parts that can be produced with these easy-to-machine *Stainless* Steels.

Can you apply the advantages of Carpenter Free-Machining *Stainless* Steels to your new or redesigned products? Your nearby Carpenter representative will be glad to sit down with you and discuss your problems. Call him in today or write us at the mill.

IF YOU DO NOT already have a copy of our 98-page book "Working Data for Carpenter Stainless Steels", drop us a note on your company letterhead, indicating your title.

THE CARPENTER STEEL COMPANY, 121 West Bern Street, Reading, Pa.

Carpenter STAINLESS STEELS

...for
Strength
Rigidity
Heat Resistance
Corrosion Resistance
Longer Product Life
Sales Appeal

BRANCHES AT
Chicago, Cincinnati, Cleveland, Detroit, Hartford, Indianapolis, New York, Philadelphia, St. Louis

Washington . . . L. W. MOFFETT

• Steel Division soon to close down . . . Entering new priority stage, using three ratings . . . Pricing of steel expected to be eased off gradually.

WASHINGTON — Pared down from a wartime peak of 800, the WPB Steel Division personnel has been skeletonized to approximately 120 employees. With wide-scale revocation of orders, putting the steel industry pretty much on its own, government regimentation now consists largely of specialized police work and by the end of the year the entire division, except for possibly a few key men, probably will close shop in line with the pattern of the wearing away process of WPB itself.

The folding of the Steel Division, which set in rapidly with the cancellation of enormous military orders, has left it with little to do. Chiefly it is concerned with the remnants of CMP which will go out the window on Sept. 30. Then the division will have some fringes to clear away before it finally rolls its last job.

This end move will be in the nature of a new small time priority system, with three ratings: Triple A; MM and CC.

Triple A will govern priorities for so-called extreme emergencies, if they develop, to assure materials by directives for consumers who are unable to get unrated tonnages. This system will have limited application since industry has set a surprisingly rapid reconversion pace, and barring labor difficulties promises to be able to supply all steel and material needs, with possibly a temporary pinch in lines such as sheets and tinplate.

MM ratings will be used for military needs but they will be relatively small and will chiefly relate to material for occupation forces abroad.

CC ratings will be established to break so-called reconversion bottlenecks for non-military requirements. The purpose will be to make an equitable distribution among consumers where there may be tight spots, and to prevent an excessive quantity of steel and other supplies from going to large users at the cost of smaller consumers. Given uninterrupted production of steel, this rating will be used sparingly and then only in the case of bottlenecks.

Called an anti-inflationary measure, there is also talk that has not yet jelled into a definite plan which would require government approval of home construction, an action that builders vigorously oppose. The necessity for this would depend, it is contended, on the effect of complete elimination of building restrictions by WPB.

STEEL pricing gives every indication of continuing until OPA itself is wound up. By statute it has until June 30, 1946, to live. But with the war's end the public has grown restless over many controls. Though it definitely does not want to see prices skyrocket, the public, with industry, clearly feels there are numerous ceilings maintained that are unnecessary. Some groups go so far as to believe that all controls should be lifted at once, contending that this would further release civilian production and set up competitive conditions that would without government direction control the price structure.

The majority view probably is, however, that certain controls are necessary for some months, perhaps through the spring. It therefore would not be surprising to see Congress refuse to renew the Price Control Act. Until then, it is likely that common steel products will continue to have ceilings. At the same time, there may be other steel products gradually released from price control as production gains and keeps up with or exceeds supply. This is a basic principle under which OPA is administered as announced by Administrator Chester Bowles and as evidenced by moves it has taken.

It has lifted a great many products from both rationing and price control. Outstanding examples of price lifting in the metal fields are magnesium and aluminum. A number of steel products are moving into the category where, based on supply and demand, prices can safely and even advantageously be left to competitive operations. Exceptions to this as the situation now exists are held to be such lines as flat rolled products, whose outstanding consumer, the automobile industry, will require an increasingly large quantity as it gets its assembly lines moving at a speeded tempo.

However, with complete elimination of price controls, OPA as an operating agency will make its final bow from the control arena.

Terminated Contracts Materials Controls Eased by War Dept.

Washington

• • • Controls over contractor dispositions of raw materials, work-in-process and other items of inventory left over from terminated war contracts, were revised by the War Department on Sept. 1.

These changes in the Joint Termination Regulation, the War Department said, are designed to encourage contractors to retain inventory for use in civilian manufacturing and, at the same time, tighten controls over contractors' sales of termination inventory.

The three new provisions, which principally concern the price at which a contractor may retain termination inventories for his own use and sell it on behalf of the government, affect larger manufacturers and suppliers with claims of over $10,000.

As outlined by the War Dept., the primary changes are as follows:

1. To encourage a contractor to retain inventory from his war work for use in his peacetime manufacture, the floor under the price the contractor had to pay has been removed. Earlier, the contractor with a termination claim of more than $10,000 was required to pay "the best price obtainable" in the light of market conditions, but not less than 75 pct of cost. Beginning Sept. 1, he must still pay "the best price obtainable," but the 75 pct minimum is eliminated and the

Let the Basic Engineer give you facts and figures on the remarkable savings in time, labor and refractory expense being realized in some electric steel plants through the use of Gunmix.

PROFIT FROM THIS OLD CHINESE CUSTOM

EVERYBODY has heard the saying that in China you pay the doctor to keep you well.

Isn't that the wise way to look after the health of your basic open hearth and electric furnaces, too? Isn't it more efficient practice to keep furnace hearths and linings in sound condition, than to permit them to deteriorate at an accellerating rate until you have to shut down and rebuild?

Take for example, basic electric furnace sidewalls! Some operators delay an extra 30 to 50 minutes about once a week to give the hot sidewalls a coat of Gunmix, with the Gunmix Gun. This keeps the walls firm and clean and actually prolongs their useful life a hundred heats or more. Furthermore, accurately recorded costs show that this maintenance practice, as compared to shutting down for frequent relining jobs, not only reduces refractory costs, but also results in more hours of steel production.

There is a "doctor" ready to help you protect the good health of your furnace walls, banks and bottoms—the Basic Engineer. He is a graduate of the school of experience. He knows steel production because he has actually made steel. He talks the steel man's language, diagnoses a tough case and prescribes successful refractory treatment. Regular consultations with him will keep your furnaces well.

BASIC REFRACTORIES, INCORPORATED 845 HANNA BUILDING *Cleveland 15, Ohio*

contractor merely states in writing that he intends to use the material in his plant and will not resell it in its existing form at a profit. The price set remains subject to approval by the Government.

2. Contractor sales of scrap, salvage and other unserviceable items in termination inventory have been placed under closer control. If the contractor's claim is over $10,000, the contractor can sell only on competitive bids. He must permit inspection of the property by prospective buyers and the sales price remains subject to approval by the government.

3. Provisions also have been changed on contractor sales of serviceable property—items usable as a unit. Whenever the amount of this type of termination inventory that a contractor puts up for sale at any one time or place costs more than $10,000, he must advertise the sale in a local newspaper seven days in advance. The sales price remains subject to approval of the government, but the floor under the price has been cut from 75 pct of cost to 50 pct.

The Joint Termination Regulation contains simplified provisions for disposal of small lots of termination inventory, but the amount that a contractor may dispose of as a "nominal quantity" without approval by the government has been cut from $2500 to $300.

This revision of the Joint Termination Regulation, the War Dept. pointed out, incorporates the policy expressed in the SPB Regulation No. 9 that subcontractors shall be permitted to retain, as against their upper tier contractors, whatever termination inventory they wish. Exceptions will be permitted only in cases where contract rights of upper tier contractors make this necessary.

At the same time, the OPA announced pricing procedures to be followed by war contractors who elect to retain the inventory left over from terminated contracts.

Where price ceilings are already in effect for the same materials when sold in regular commercial trade, these ceilings will apply to retained inventory stocks, OPA said.

In those cases where there are no existing price ceilings, vendors will follow simple formulas in arriving at ceiling prices. There are special formulas depending upon whether the materials are in completed form, only partially completed or in raw state.

However, OPA may establish special prices or exemptions where those inventory pricing provisions are not sufficiently adaptable for a particular class of products or commodities. This new regulation is designated as Supplementary Order No. 130 and becomes effective Sept. 5.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

SEE THAT SILVER PLATE IN MY SKULL? I FELL ON MY HEAD ONCE! SEE THEM VARICOSE VEINS? SEE THEM FLAT FEET? AN' I GOT BAD EYES AN' A BROKE ARM THAT WASN'T SET RIGHT! 'AT'S WHY I COULDN'T GO IN TH' ARMY-- SO I TOOK UP TH' MACHINIST TRADE!
HE AIN'T TAKIN' IT UP, HE'S TAKIN' IT DOWN! HE'S NO GOOD FER ANYTHING ELSE, SO HE'S JOININ' US, HEY?
BUT HE'S SO BUSY APOLOGIZIN' FER NOT BEIN' IN TH' ARMY THAT HE'S GIVIN' AWAY WHY HE WON'T BE WITH US LONG!
J.R.WILLIAMS
9-14
THE SHORT SHIFT
COPR. 1945 BY NEA SERVICE, INC. T. M. REG. U. S. PAT. OFF.

New Year's Day Set As Deadline for Clearing Contract Negotiations

Washington

• • • The Navy has announced a time-table for settling most of its War Contracts by New Year's day. The Navy, said Assistant Secretary H. Struve Hensel, wants to clear up the bulk of contract negotiations promptly, not only to facilitate plant clearance and return to civilian production, but also to speed the return to civilian life of Naval Reserve contract-termination personnel.

He pointed out that contract settlement must be initiated by the contractor. Of the 50,000 contracts terminated since V-J Day, it was estimated that 15,000 will involve claims against the government for termination costs.

"If the contractors will file their claims by Oct. 15," the assistant secretary said, "the Navy will undertake to have them reviewed by inspectors of material and forwarded to the contracting officers by Nov. 15. The goal of contracting officers for final settlement is set as 30 days after they receive the claims.

"This will make enormous demands upon contract termination activities, but we believe our goal can be met if—and this is a big 'if'—the Navy's contractors file their claims quickly. Therefore we ask them and urge them to exert their maximum efforts toward this end.

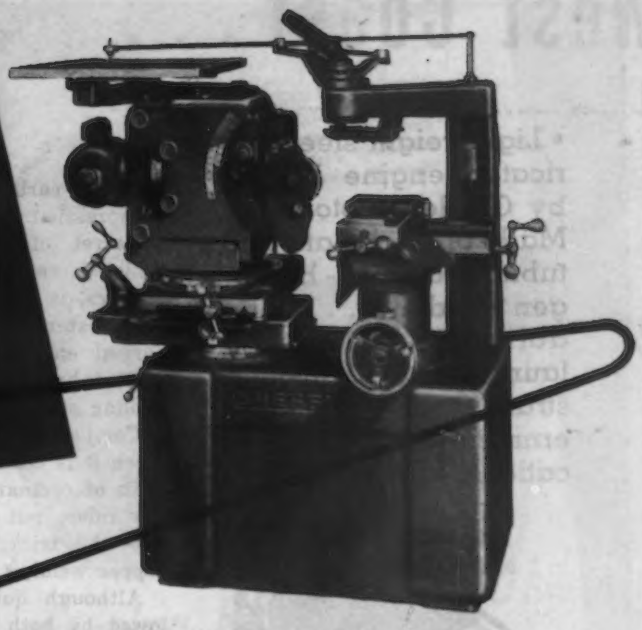
"Procedures are in effect to make liberal partial payments in advance of settlement within 30 days after the contractor applies. Material inspectors and inventory disposal experts are ready to help contractors with termination problems."

In cooperation with the Army, the Navy has sponsored training programs for contractors to prepare them for the problems of settlement. Contractors who are unfamiliar with settlement procedures were told that they should communicate immediately with their government contracting agency, or with one of the 20 regional Termination Coordination Committees.

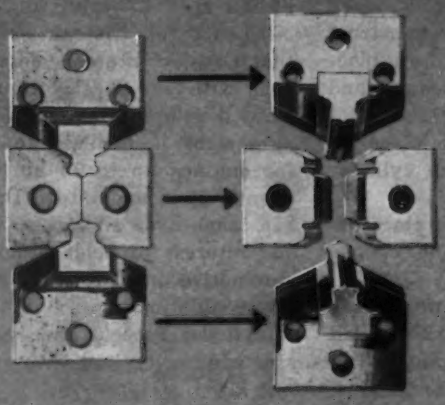
MAKE PUNCHES AND DIES

In Half the Time

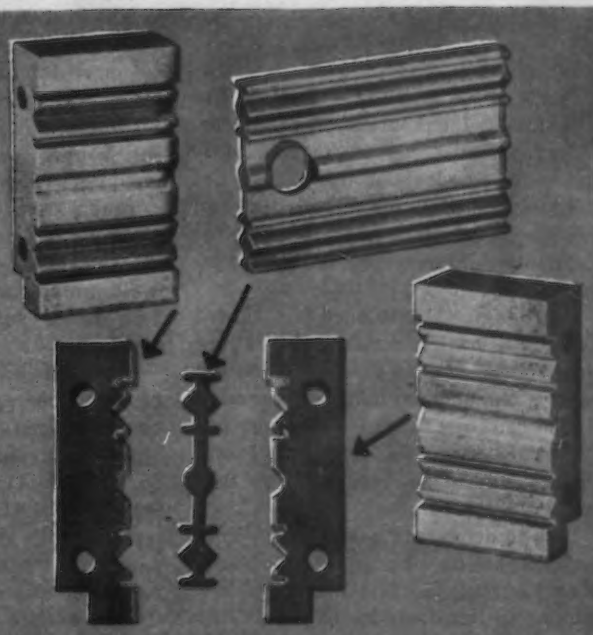
TO PRECISE LIMITS



MICRO-FORM GRINDER



If you are grinding punches and dies to close tolerances, you will be interested in the following performance figures. Herewith is illustrated two punches and a pair of matching die halves for producing the notched forms at the ends of a standard razor blade blank. Each punch is ground in 6 hours and the die halves, with closely specified clearance angles, are ground in 6 hours apiece.



Shown here are a die set—a punch and two die halves for slotting razor blade blanks—a difficult, precise grinding job. The punch, about 2 inches long, is ground from a roughed-out heat treated blank in just 16 hours including all alignment and checking. The two matching die halves are ground in 8 hours each (floor-to-floor).

write for booklet M-120-144 telling how to grind profiles direct from the drawing faster and at lower cost.

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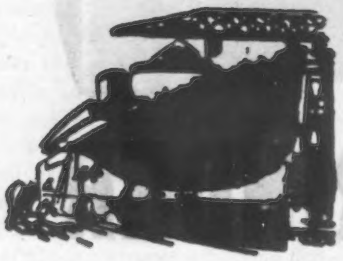
MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES

West Coast . . .

OSGOOD MURDOCK

• Lightweight steel fabricated engine bought by Crosley Motors . . . Made of steel plate and tubing, copper - hydrogen welded . . . Billion dollar CVP program launched . . . Transition strain eased by government - endowed vacations.



SAN FRANCISCO — Taylor Engines, Inc., patentors of a steel fabricated engine, have recently granted Crosley Motors, Inc., of Indianapolis, full manufacturing and sub-licensing rights on their motor for automotive, marine and aviation purposes.

The engine, developed by Lloyd Taylor, a local combustion man at one time identified with the Miller racing cars, is one of many efforts to develop a "tin-can" or fabricated motor, but distinguished by the fact that Powel Crosley and other experts think that it may be the solution.

Said to deliver its power at the lowest weight per horsepower of any known engine, the first model was developed in San Leandro in 1941. This original 26 hp motor delivered at the rate of one hp per 1¼ lb. Secret of its success is use of the copper-hydrogen brazing process.

Shrouded in more than the usual amount of secrecy, little information is available on the early experimental and test models, and virtually none since the entry into the picture of the Navy, the Army and Mr. Crosley. Best reports indicate that after the initial 26 hp model, the next one was a six-cylinder, 250 hp job. It is known that the inventor's objective was a reduction to ⅞ and ½ lb per hp which is believed to have been achieved and that the shop-built experimental version used an old model-T carburetor and developed a compression ratio of eight.

Secret of the motor's efficiency, which is confirmed from independent sources, is its ability to dissipate its heat faster than the ordinary cast and forged engine. Overheating is controlled by the engine's own special cooling system.

Comparative costs can be estimated when it is realized that the engine is built of ordinary plate steel and hollow tubes, put in a jig and stamped out—the trick of course being the copper welding.

Although quietly and closely followed by both automotive and steel men, little accurate data is available on recent development work as talk is bandied about that Crosley has subsequently spent a million dollars on the development in conjunction with the Army and Navy.

The first 26 hp model was fabricated from lightweight sheets and required no close tolerances and Mr. Taylor's flash of inspiration was to construct all joints and seams to facilitate placing copper wire in the seams, and welding with hydrogen at 2100 F.

Liners were shrunk into place by applying steam heat to the cylinder blocks and dry ice to the liners.

Stampings were tacked in place before being subjected to the copper welding.

The crank and camshafts were made of plate, bar and tube sections which also required copper welding. The crankshaft consisted of 12 sections of ½ in. SAE 41 steel to balance bearings of SAE 4140 bar stock. The plate was cut with standard burning equipment and the bars were sections prepared on automatic screw machines, the advantage being the difficulty in forging as many throws as would be needed for this length of shaft.

The camshaft was made of low-carbon steel tube threaded through several bar sections which serve as cams. Initial engineering raised some question as to whether these plates and bar sections were more efficient than the forged. And, of course, it was naturally feared that the light construction would be thrown out of alinement by heat and vibration, but reports indicate that this is not the case, and if the Crosley arrangement may be taken as confirmation, the problem appears to be licked. At any rate the Navy is said to have installed several of the engines on light craft and that while their experts still don't believe the performance records, they can't deny the evidence of their own eyes. Collaterally, when the Army was looking for a lightweight engine during the early part of the war, they had Mr. Taylor draw plans for a pancake-size engine which met every requirement on paper. However, this model was not adopted due to the need for standard equipment, parts replacement and servicing in every remote corner of the world. Otherwise the Taylor engine might already be powering the craft subsequently named the "Weasel."

EARLY checking of the engineering data was done by members of the engineering staff of Stanford University and the copper-hydrogen brazing by General Electric. And while subsequent development has been pretty much of a closed subject —in that none of the backers, headed by Earnest L. Smith of San Francisco, will talk—it can be determined that Crosley interests entered into a deal with the local owners for the Navy development work. The original agreement is believed to have been for engines up to 75 hp, but subsequently it is understood that Crosley has taken over all rights, which may add interest to fields other than the automotive in that parts are interchangeable for the 4, 6, 8 and various 12-cylinder models and that the engine can be serviced with an ordinary tool kit.

As a matter of added interest, the Joshua Hendy and Henry Kaiser people looked at the engine as far back as 1941, although it is not believed currently that the engine can be put into quantity production in time to power the Kaiser-Frazer cars —assuming that the Crosley interests would sub-license to them.

As a postscript, the Taylor engine is described as an unsung western industrial tragedy of the war. As initial experiments were just proving up in 1941 and development work took time, owners of the patents were obliged to go East due to manpower and material shortages and lack of facilities for mass production, sacrificing all but their financial interest and the kudos that may go with having developed the first practical fabricated steel engine.

* * *

The U. S. Bureau of Reclamation at

FORMERLY: Separate hardened race pressed on axle.
WITH TOCCO: Surface hardened to 62 R.C. at the bearing, axle acts as its own race. Increased diameter gives 50% more strength.
Bearing Race PRESSED ON
Bearing Race PRESTO!

300 races per hour . . . 50% stronger axles with TOCCO

AXLE shafts can serve as their own bearing races when the surface is given superhardness by TOCCO Electrical Induction. This eliminates the separate inner bearing race formerly pressed on . . . and by increasing the axle diameter at the bearing gives 50% more strength.

One TOCCO installation, hardening 300 axle bearings per machine per hour, has paid for itself from savings within a few months. The high quality of results is attested by millions of these axles now in service.

For YOUR Problem. This technique for producing integral bearing races can be applied to machine parts of many types and sizes . . . to quicken your race to market and to give you better products at lower cost. TOCCO simplifies reconversion these ways: Cuts heating time to seconds; eliminates straightening, scale cleaning and other operations; banishes rejects; enables you to spot heat-treating in the production line; gives you 100% uniformity of results with unskilled operators.

Enlist the TOCCO Engineer in *your* reconversion plans. No obligation. Write for free booklet, "Results with TOCCO".

THE OHIO CRANKSHAFT COMPANY · Cleveland 1, Ohio

TOCCO

INDUCTION

HARDENING, BRAZING

ANNEALING, HEATING

Sacramento has issued a 300-page report on its recommendations for California's land, power and water needs.

The program includes 13 multiple purpose dams, numerous reservoirs and canals with $527 million listed as construction costs for a 15-year program and $1,800,000,000 for the completion of the whole program which would employ 18,000 men over the 15-year period.

Costs of operation and amortization are set at $99,730,000 annually against what the Bureau refers to as "monetary benefits" of $275,000,000 annually.

* * *

California's employment weather appears to be clearing a little more as each day passes. Present estimates are that 60 days will show well-defined trends with not too much damage done.

From mid-July to mid-August private shipyards released 11,000 workers, reducing employment in the industry to 126,200. The total reduction of employment in durable goods industries has been more than offset by an increase of almost 3000 over total employment figures of July. However, these figures do not yet represent the results of Japan's surrender. Current outlook for southern California still appears up in the air. Backlog of orders in the south for the airframe industry is $1,029,000,000 compared to $279,000,000 for the entire industry in 1939, and although this industry and the southern half of the state was hardest hit by layoffs, between 50,000 and 60,000 jobs are listed as available.

WMC figures show that 83,000 workers were dropped from payrolls 10 days after V-J Day, but simultaneously applications for unemployment compensation skyrocketed to 71,000, but adding 23,000 listed jobs available in the Bay region to southern California's total leads to the conclusion that a substantial number of workers prefer a government endowed holiday to the alternative of transferring to a peacetime job.

Although the picture is not yet altogether bright, it is alleviated by the necessity of bringing the state's sizable construction program up to the engineering and specification stage.

C. H. Purcell, state director of public works, believes that it will take a good 90 days to get the road construction program underway and private employers are now concerned over the prospect of having to compete for workers when the public construction program starts and the workers have returned from their subsidized vacations.

As specification plans lag elsewhere on the Pacific Coast, laboratory and wind-tunnel experiments on the spectacular Tacoma Narrows Bridge may make this the first sizable postwar construction job on the Coast.

Under the direction of Prof. F. B. Farquharson and Charles Andrew, chief engineer for the Washington Toll Bridge Authority, further tests have reduced shimmy to a nominal point, so that contracts may be let by the first of the year.

Reason for the sway in the original bridge was found to be the wind shearing off in alternate patterns from the plate girder. The research problem was to find a section in which this would not occur. First tests on an improved model showed some correction, but addition of continuous concrete slabs under each of the four traffic lanes reduced the sway to a satisfactory minimum. Torsion of plus or minus 2 deg. may still prevail with a rising air current of 4 to 10 deg. over a period of 30 min. This condition occurs so infrequently and resultant vibration would still be so insignificant that the performance of the new model is considered satisfactory.

Cost of the new structure is estimated at around $7 million, involving 13,000 tons of structural steel and 5000 tons of cable wire. The new bridge will have a 2800 ft. center span and two 1100 ft. side spans utilizing present foundations and the west approach, and again will be suspension type.

* * *

Like King Canute, Boeing Aircraft's new president, William M. Allen, found his first job to be stemming the tide of a surprise Army cutback which reduces the company's output to 50 planes for September and eight a month thereafter.

All operations are to be discontinued at Boeing's branch plants and at the Vancouver subsidiary, as well as subcontracting at Puget Sound Sheet Metal, Pacific Car & Foundry, Kenworth Motor Truck and Jensvold Co.

Boeing still has contract orders for an undisclosed number of C-97s which is their postwar airline plane.

Westinghouse Ship Propulsion Contracts Slashed $12 Million

East Pittsburgh

• • • **End-of-war termination** of more than $12,000,000 of Navy contracts for warship propulsion equipment at the Steam Division of the Westinghouse Electric Corp. was reported by L. E. Osborne, vice-president. The cancellation figure may ultimately reach about $19,000,000, he revealed, of a total war materials backlog in the division of $34,000,000.

"Obviously such a reduction in backlog of orders brings with it certain problems of readjustment of peacetime production," Mr. Osborne said, "but our peacetime production prospects at the South Philadelphia Works, including the new Aviation Gas Turbine Division, are bright compared with anything we knew in normal peacetime years. Even before the war with Japan ended Aug. 14, reconversion within the Steam Div. was well under way.

"Even if wartime production schedules had continued through this year, nearly 18 pct of the division's 1945 production would have consisted of normal peacetime electric power-producing machinery needed to help solve the nation's reconversion problem." In 1944, he said, only about two pct of the division's production went to civilian customers.

While immediate employee layoffs will be comparatively light, Mr. Osborne said, within the next few months 2000 to 2500 war workers will have to be released.

"Normal prewar business of the division averaged from $12,000,000 to $15,000,000," he added. "The already booked civilian orders for 1946 are greater than this prewar average, and are conservatively expected to reach $23,000,000. The division is looking to a subsequent annual average business of about $19,000,000.

"An indication of the nation's need for increased production of electric power—some two-thirds of which comes from steam turbine power—is the expectation of our own company's Electric Appliance Division at Mansfield, Ohio, that production of power consuming appliances will account for a $100,000,000-a-year increase over prewar sales."

CHICAGO CUT-OFF WHEELS

From the swift era of war production comes another modern miracle, the cut-off wheel—man power and man hour saver—for the fastest, smoothest method of cutting tubing, wire, steel and brass sheets, glass, porcelain, Stellite, tungsten, plastics, laminates and other hard-to-slice materials.

When RT, the special formula bond was developed, it put the cool-running CHICAGOS 'way out in front in real performance records.

Available in rubber or resinoid—a full range of styles and sizes. 3 bond types—for every operation.

WANT TO TRY ONE? Tell us what you have to cut, grinder you use and size wheel you'd like. We'll send a test wheel promptly. *Write for Circular.*

CHICAGO WHEEL & MFG. CO.

Originators of the famous Chicago Soft Rubber Polishing Wheels

1101 W. Monroe St., Dept. RA, Chicago 7, Illinois

MADE WITH RT

THE NEW BOND THAT HOLDS ITS OWN . . . GIVES ONLY WHEN IT MUST!

Send CIRCULAR____ SEND TEST WHEEL____ SIZE____ TO CUT____

NAME_____

ADDRESS_____

CITY_____ STATE_____ RA

PERSONALS

° ° °

• **H. E. Heilman** has been made operations manager for the B. F. Goodrich International Div., Akron, Ohio.

• **Lt. Col. H. A. Stevenson,** until recently attached to General Staff Corps, Army Service Forces, has returned to Detroit as distributor in the Michigan territory for the Baker Industrial Truck Div. of Baker-Raulang Co., Cleveland.

• **G. L. Crow** has been appointed manager of the marine section of General Electric's Pacific District Industrial Div. Mr. Crow's headquarters will be at San Francisco.

• **James H. Rasmussen** has resigned as general sales manager of the Manufacturing Div. of the Crosley Corp., Cincinnati. Mr. Rasmussen leaves his present post to become a vice-president of the United Wall Paper Co., Chicago, and will assume his new position on Oct. 1.

• **Henry A. Bourne** has been appointed sales manager for Republic Steel Corp. in the Tulsa, Okla., district. He joined Republic in 1943 and prior to that was district sales manager in Houston for the A. O. Smith Corp., Milwaukee.

HENRY A. BOURNE, sales manager, Tulsa district, Republic Steel Corp.

• **Capt. Ralph E. Lee** has been named manager of the export dept. of the Trane Co., La Crosse, Wis.

• **W. E. Knapp, Jr.,** has been appointed branch manager of the Westinghouse Electric Supply Co.'s Fort Worth house, Tex., succeeding **E. C. Cummins,** who resigned.

• **Lewis A. Harlow,** former assistant advertising manager of Fairbanks, Morse & Co., Beloit, Wis., has been named advertising manager.

• **H. LeRoy Whitney,** formerly technical consultant to WPB Chairman, Donald M. Nelson, has been elected chairman of the board, Intercontinental Distributors, Inc., New York and Washington, D. C.

AUBREY M. CALLIS, sales manager, Federated Metals Div., American Smelting & Refining Co.

• **Aubrey M. Callis** has been made sales manager of the Whiting and Detroit plants of Federated Metals Div., American Smelting & Refining Co., with headquarters at Whiting, Ind.

• **Max J. L. Schulte** has resigned as vice-president, secretary-treasurer and general manager of the Rawlplug Co., Inc., New York, after 21 years of association with that organization.

• **Hugh C. Crawford** has been appointed director of sales for the Egyptian Lacquer Mfg. Co., New York. During the past three years Mr. Crawford has headed the War Production Div. of the company.

WM. E. HOARD, area sales manager, Western Gear Works.

• **Wm. E. Hoard,** former assistant to the sales manager of Western Gear Works' three West Coast plants with headquarters in Seattle, has been appointed area sales manager of the San Francisco area for that firm and its associate, the Pacific Gear & Tool Works.

• **A. Carl Tiedemann** has been recently elected president of the Dockson Corp., Detroit. Mr. Tiedemann joined the company less than a year ago as executive vice-president and general manager.

• **Carl P. Sorenson** has recently been appointed consulting standards engineer for the Cherry Rivet Co., Los Angeles. Mr. Sorenson was formerly with the Glenn L. Martin Co., Baltimore.

• **Christian Pretz,** assistant to the vice-president of the Studebaker Corp., South Bend, Ind., has resigned after 32 years with the organization. He is leaving to accept a position as vice-president of the Durham Mfg. Co., whose administration office is in South Bend.

• **Ralph G. Rogers** has joined American Central Mfg. Corp., Connersville, Ind., as works manager, coming from Republic Aviation Corp. at Evansville, Ind., where he was factory manager.

• **Gaston F. DuBois,** vice-president and member of the executive committee of Monsanto Chemical Co., retired Sept. 1. He will continue as a director and also will serve as consultant to the company.

Pygmy PARTS or *Giant* CASTINGS

Fairbanks-Morse Scales Guard Accuracy

AT the Manitowoc Shipbuilding Co., Fairbanks-Morse Crane Dial Scales have the unusual job of weighing four-ton ship castings.

In other industries they weigh tiny parts where it takes thousands to make up a ton.

In still other applications, Fairbanks-Morse Scales operate as units in fast-moving production lines . . . or they keep records . . . or help mix formulas.

They can be engineered to operate in Arctic cold or blast-furnace heat. They can be adapted to withstand dripping wetness.

And in every job they're lastingly accurate.

They can help you solve any weighing problems you can think of, and a great many production problems you might not think of. A Fairbanks-Morse engineer will be glad to work with you. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY VICTORY BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

KENNETH H. GAYLE, JR., vice-president in charge of sales and exports, Ingalls Iron Works Co.

C. S. HEGEL, manager, Special Steels Dept., Joseph T. Ryerson & Son, Inc.

• **Kenneth H. Gayle, Jr.,** has been elected vice-president in charge of the Northern Div. sales and exports of the Ingalls Iron Works Co., Birmingham, and its subsidiary, the Steel Construction Co. Mr. Gayle has served as Northern Div. sales manager since 1939 and as export manager since early last year.

• **Eric S. Carlstein** has been appointed general manager and assistant to the president of Pines Engineering Co., Aurora, Ill. Mr. Carlstein was formerly chief engineer of the Batavia Metal Products Co. **C. F. Coats,** formerly of Western Condenser Co., Watseka, Ill., has been appointed purchasing agent.

• **C. W. Yerger,** formerly executive vice-president of the Hanson-Van Winkle-Munning Co., has joined the executive staff of the Lea Mfg. Co., Waterbury, Conn., and has been elected chairman of the board of directors.

• **Albert L. Wiley,** for the last five years with the Norton Co., Machine Div., sales dept., Worcester, Mass., has retired. Formerly he was connected with the credit and planning depts. and for 10 years was credit manager in the Detroit office of the company.

• **R. W. Otte** has been appointed assistant purchasing agent of the Chicago Great Western Railway Co., Chicago.

• **F. Carroll Stille** of Cornell & Underhill, Inc., New York and Hoboken, has been appointed sales manager.

• **C. S. Hegel** has been recently appointed to the position of manager of the Special Steels Dept., Chicago plant of Joseph T. Ryerson & Son, Inc. Mr. Hegel joined the Ryerson Chicago Special Steels Div. in 1928, where he remained until 1932 when he was transferred to Milwaukee as special steels representative.

• **Capt. Frederick H. Parkin** has returned to his former position with the William M. Parkin Co., Pittsburgh, chemical engineers to the steel industry, where he was employed for several years prior to induction in the army.

• **F. W. Elya** has been appointed district manager Abrasive Div., of the newly created Northeastern district by Norton Co., Worcester, Mass. **R. J. Forkey** who has been abrasive engineer in the Syracuse territory will take over the western New York state area formerly covered by Mr. Elya and **Robert Cushman** from the Norton Worcester office will take over Mr. Forkey's former territory.

• **Wilbur F. Campbell** is resigning his position as assistant to the president of the Pioneer Engineering & Mfg. Co., Detroit. Mr. Campbell's duties included handling all the legal aspects of war contracts and government relations. He plans to re-enter private practice and has opened his new law offices in Detroit.

• **Albert C. Nute,** who was publicity director of the Hudson Motor Car Co. for two years, has been appointed to the Ross Roy, Inc., public relations staff, Detroit, and **Donald P. Markus,** who has specialized in agricultural research, was appointed to the company's research staff.

• **George E. McGuire** has been made director of foreign sales of the Carborundum Co., Niagara Falls, N. Y. For the past nine years Mr. McGuire had been sales manager of the export dept. of the company. He entered the employ of Carborundum in 1911, as a member of the New York district sales office staff.

• **W. E. Dueringer** has been appointed assistant sales manager and **H. E. Weaver** proposition dept. manager of Bailey Meter Co., Cleveland. Both Mr. Dueringer and Mr. Weaver have been associated with Bailey Meter for over 25 years in various engineering and sales capacities.

• **Sterling Smith** has announced his resignation as manager of the Refrigeration Div., Mills Industries, Inc., Chicago.

OBITUARY...

• **Robert Atkinson,** 53, district manager since 1927 of the Steel & Tube Div. of the Timken Roller Bearing Co., Detroit, died recently.

• **Fred A. Pawsey,** 63, chief engineer of the Ohio Locomotive Crane Co., Bucyrus, Ohio, died Sept. 3.

• **Col. Paul R. Hawkins,** 78, retired assistant to the president of the Pullman Standard Car Mfg. Co., and before going with that company in 1914 special representative of the Norton Co., died recently.

• **William P. Collins,** recently in charge of foundry production expediting for WPB in San Francisco and previously proprietor of the Western Brass Mfg. Co., died suddenly Aug. 30. He had been active in San Francisco Bay area foundry circles for four decades.

• **Dr. Erich Loewenstein,** 58, biological chemist, Bausch & Lomb Optical Co., died Aug. 27, following six weeks' illness.

• **Hubert E. Mills,** 60, secretary-treasurer of the Alabama Mining Institute, Birmingham, died at Birmingham, Aug. 19.

WHEN YOU

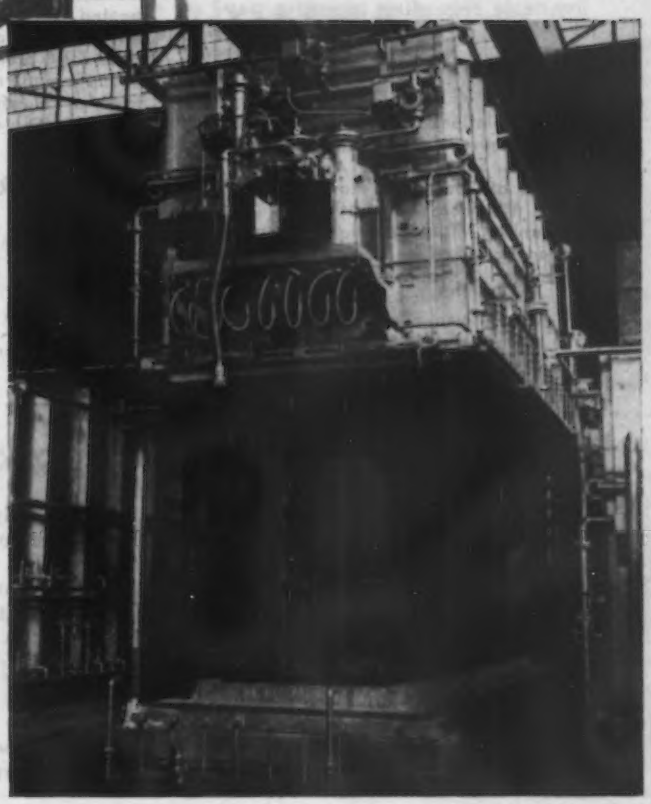
CALL SALEM

ABOUT HEATING FURNACES

STEP 2

GO TO WORK!

VISUAL SPECIALISTS



You want the newest innovations and cost-cutting war ideas built into your new heating furnaces and allied equipment.

When you *call Salem,* a heating engineer discusses your requirements and passes along useful information derived from diversified experience during and before the war.

He returns to Salem, talks over your needs with Salem's staff of experienced heating men. Then he sends the visual experts into action, drafting up ideas.

After you have approved plans, working blueprints are prepared. Construction starts and the finished installation represents the most efficient heating or heat treating department you can buy.

Cutting your maintenance and operating costs begins with thorough planning between you and an experienced equipment manufacturer. That's why we suggest you CALL SALEM for heating furnaces or allied equipment.

Builders of the world's largest rotary forge furnace and originators of "Engineered Heat."

NOTE: Write for Salem's new 16-page, illustrated booklet—"Engineered Heat," complete with easy-to-use heating and temperature charts.

Salem Engineering Company builds all sizes and types of heating furnaces and allied equipment. Many heating innovations have been originated during the war. Salem can incorporate these cost-cutting ideas into your new heating furnaces and allied equipment. . . . CALL SALEM.

SALEM

ENGINEERING COMPANY

SALEM, OHIO

Engineered Heat

Dear Editor:

SAE 52100 METALLURGY

Sir:

Please send reprint of "Metallurgy of SAE 52100 Ball Bearing Steels" by Lieut. (j.g.) R. J. Haften from the July 5 issue.

EMERSON DALE,
Prod. Metallurgist
Elastic Stop Nuts,
Union, N. J.

● Reprint has been mailed.—Ed.

IRON OXIDE FILMS

Sir:

Would you send two copies of the article on "Formation and Structure of Iron Oxide Films" from the issue of July 19?

MADELEINE B. McDONOUGH,
Engineering Librarian
Friez Instrument Div.,
Bendix Aviation Corp.,
Baltimore 4

● Tear sheets have been mailed.—Ed.

INCENTIVE PLAN

Sir:

We are interested in a piece rate or an incentive plan for foundry employees. Do you have any material available regarding incentive pay?

T. G. WARD,
Personnel Manager
Wayne Foundry Co.,
Detroit 10

● Compilations of articles on time study and incentives in general under the titles "Method Simplification Applied to Time Study", at 35¢, and "How to Rate Shop Jobs", 50¢, both compilations for 75¢, are available. The publication "Occupational Rating Simplified for Foundries" by Gottfrid Olson of the National Founders Assn., 120 S. LaSalle St., Chicago, might also be helpful. This volume is published at $1 and is free to members of the association.—Ed.

BERYLLIUM COPPER

Sir:

Would you kindly supply us with the addresses in the U. S. of manufacturers of beryllium copper wire?

H. FREEMAN,
Technical Director
Consolidated Paper Corp. Ltd.,
Three Rivers, P. Q.

● The Beryllium Corp. of Pennsylvania, Reading, Pa.; Little Falls Alloys, Inc., Paterson, N. J.; Spencer Wire Co., West Brookfield, Mass.; and National-Standard Co., Springfield, Mass.—Ed.

INDIUM SOURCES

Sir:

Would it be possible for you to furnish us with the name of a producer or supplier of indium metal?

JOHN J. SMITH,
Research Laboratories
Pittsburgh Plate Glass Co.,
Creighton, Pa.

● Producers are the American Smelting & Refining Co., 120 Broadway, N. Y., and Indium Corp. of America, 60 E. 42 St., N. Y.—Ed.

IRON POWDER

Sir:

We notice that you consistently quote the market on iron powder, hydrogen reduced, 300 mesh and finer, 98½ plus pct Fe in drum lots at approximately 63¢ per lb. We should appreciate knowing what type of industry makes use of such a fine product.

LOUIS D. HUDON,
Comptroller
Sorel Industries, Ltd.,
Sorel, P. Q.

● This powder is used for the production of sintered iron cores for transformers and other electrical apparatus.—Ed.

ALUMINUM TOOL STEEL

Sir:

The following cable has been received from Sweden: "Have you any particulars of a recently developed high speed steel with aluminum?" Could you furnish us with any information on this?

A. G. DE SHERBININ,
Manager Metal Products
Pagel, Horton & Co., Inc.,
347 Madison Ave., New York 17

● No steel of this type is made in this country. A few companies have experimented with aluminum and high speed steel but the resulting alloy does not harden and shows little promise. It is possible that reference is made to some German experiments involving aluminum additions to sintered carbide cutting alloys.—Ed.

RAIL CAR REFRIGERATION

Sir:

Please wire collect the full address of Railway Refrigeration Corp. as mentioned in News Front, Aug. 2.

NATIONAL RESEARCH BUREAU, INC.
415 N. Dearborn St.,
Chicago

● 60 E. 42 St., New York 17.—Ed.

ELECTRONIC TRACER

Sir:

In the July 26 issue under News Front mention is made of an electronic tracer for gas-cutting apparatus of the pantograph type. Can you supply us with information as to the source of the development?

R. M. SMITH
Camden Forge Co.,
Camden, N. J.

Sir:

Would it be possible to give us additional information. . . .

S. S. BOARD, JR.,
Welding Engineer
Farrel-Birmingham Co., Inc.,
Ansonia, Conn.

Sir:

I should like to have information . . .

T. J. NEILAN
433 Parrott Drive,
San Mateo, Calif.

● Within about a month the company perfecting this device will make an announcement as to its availability.—Ed.

SOLVENT DEGREASERS

Sir:

Is it possible for me to secure a copy of an article appearing in your Mar. 1 issue "Safe Operation of Solvent Degreasers," by L. P. Litchfield?

J. L. BRADSHAW,
Safety Chairman
Pyrene Mfg. Co.,
Newark 8, N. J.

● Tear sheets have been mailed.—Ed.

GRINDING LEAD SCREWS

Sir:

We would appreciate your sending us three copies of the article by J. R. Moore "Grinding Lead Screws," from the June 1 and 8, 1944 issues.

M. MILLER,
Purchasing Agent
B. G. Corp.,
136 W. 52 St., New York 19

● Tear sheets have been mailed.—Ed.

ELECTROPOLISHING

Sir:

We would appreciate receiving eight reprints of "Electropolishing of Stainless Steel," which appeared in the July 12 issue, if available.

W. D. O'MORROW,
Branch Manager
Electric Steel Foundry Co.,
Portland 10, Oreg.

● Sorry, reprints of this article have not been made, but we are mailing tear sheets.—Ed.

SUBZERO HARDENING

Sir:

Thank you for the tear sheet on J. G. Morrison's article on "Subzero Hardening of High-Speed Steel" in the July 26 issue. I note now that the article appeared in two parts, and would appreciate your sending the second part appearing in the Aug. 2 issue.

FRANK McGUIRE, JR.
Linde Air Products Co.,
Chicago

● Tear sheets have been mailed.—Ed.

OPENHEARTH OPERATION

Sir:

I would appreciate tear sheets on your article "Operation of 4-Ton Openhearth" published in the Aug. 2 issue.

F. R. MORRAL
American Cyanamid Co.,
Stamford, Conn.

● Tear sheets have been mailed.—Ed.

BERYLLIUM COPPER

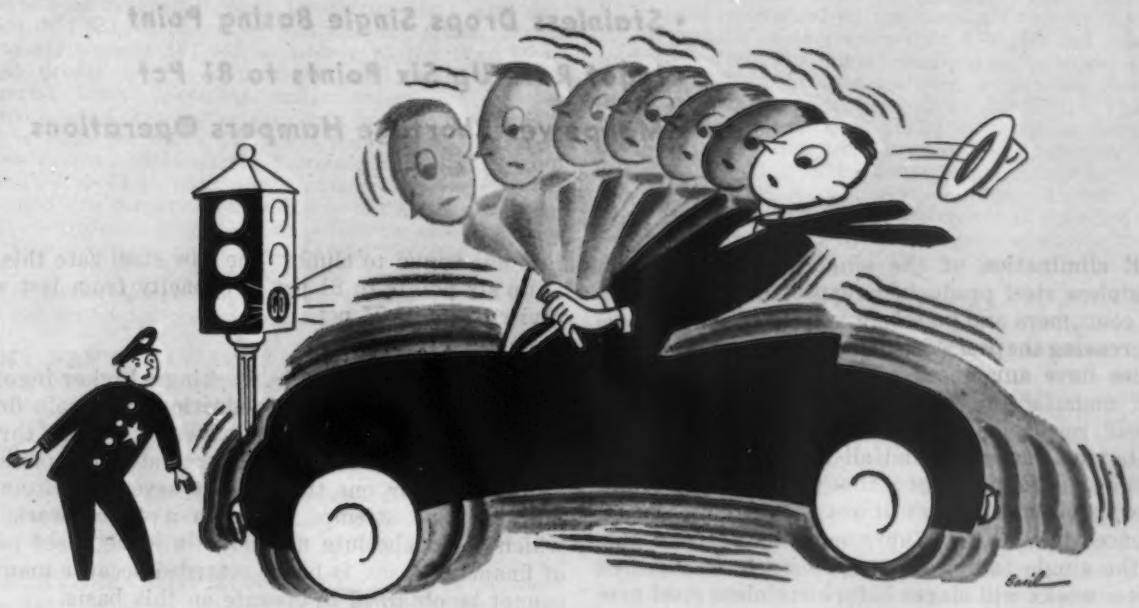
Sir:

Please send me tear sheets of your recent articles on the resistance to corrosion and wear of beryllium copper alloys.

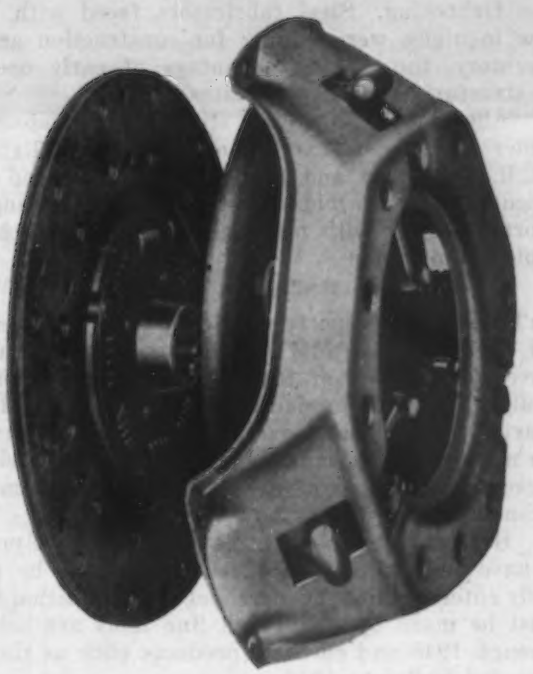
J. OGDEN,
Works Manager
Little Falls Alloys, Inc.,
Paterson 1, N. J.

● Tear sheets of "Beryllium Copper—A Preview of Its Properties" from the July 26 issue have been mailed.—Ed.

You'd start like this



–if it weren't for SPRINGS!



Muehlhausen Springs are used in Long Clutches to transmit power with "creamy" smoothness.

Smooth, easy starting is taken for granted by the average motorist. But we seldom realize that each time we stop-and-go or change a gear, clutch springs must transmit and cushion a surge of engine power.

This cushioning action is accomplished in the Long Clutch by means of Muehlhausen Damper Springs, which transmit engine power from the driven disc to the splined hub flange.

Another set of Muehlhausen Springs is in the pressure plate assembly. These springs hold the pressure plate squarely and uniformly against the driving plate—and do this while withstanding scorching engine heat.

MUEHLHAUSEN SPRING CORPORATION
(Division of Standard Steel Spring Company)
817 Michigan Avenue, Logansport, Indiana

To improve product performance, use MUEHLHAUSEN Designed SPRINGS

This Industrial Week . . .

- **Stainless Drops Single Basing Point**
- **Ingot Rate Up Six Points to 81 Pct**
- **Manpower Shortage Hampers Operations**

THE elimination of the single basing point on stainless steel products is expected to be a boon to consumers and go a long way towards substantially increasing the peacetime use of this product. Many companies have announced new basing points at the point of manufacture for various stainless products which will result in greatly reduced profits to producers, but will mean a windfall for consumers.

While this basing point action was a natural evolution in stainless steel prices, it nevertheless was largely influenced by a recent Supreme Court decision outlawing the single basing point system. It is expected that a few weeks will elapse before stainless steel producers as a whole will have made known their pricing plans.

Steel consumer reconversion requirements were shaping up rapidly in the past week accompanied by a sharp upturn in new order volume. Deliveries on products previously carrying early mill openings were also tightening. Steel fabricators faced with heavy new inquiries were buying for construction and for inventory, thus taking advantage of early openings in structural shapes and plates.

Alloy steels alone are still easy. Greatest consumer pressure is exerted on cold rolled, light hot rolled, hot rolled and pickled, and galvanized sheet schedules. In the midst of unemployment, manpower shortages rank with material shortages as a bar to rapid reconversion.

STEEL mills report practically no orders on the books carrying MM or CC ratings. This situation leaves distribution of fourth quarter production virtually up to steel producers themselves. With fourth quarter steel demand exceeding production capacity for many products, it is evident that lack of steel will prevent many types of users from fully opening the reconversion throttle.

Heavy cancellations in the recent past are proving to have been more than offset in schedules by previously entered unrated orders and lost production which must be made up. Most full line mills are sold out through 1945 and on some products such as tinplate, extended well into 1946.

Steel warehouses, war sales of which soared far above peacetime levels, are running into some difficulty in expanding their depleted stocks because steel mills desire to regain patronage of larger consumers. Those warehouses which have been selling freely in the belief that their orders on mill books previously classified as rated would assure replenishment of stocks are now finding it difficult to anywhere near satisfy their demands.

As order volume expands, deliveries lengthen, and scheduling difficulties are overcome, the steel ingot rate has begun to climb. The raw steel rate this week is up six points to 81 pct of capacity from last week's revised rate of 75 pct.

THE main drawback in reaching a higher ingot level as well as a greater production of certain finished products, are the serious manpower shortages throughout the steel industry. Most large steel companies are still short from one thousand to several thousand employees. The attempt to go on a 40 hr work week, which is an absolute necessity in some cases because of financial losses, is being retarded because manpower cannot be obtained to operate on this basis.

Carnegie-Illinois operations in the Chicago district are facing the worse manpower shortage since Pearl Harbor—lacking 3500 men at South Chicago and Gary. Two or three blast furnaces remain idle for lack of labor. Although finishing mill operations at some steel plants are close to a 40 hr week basis, blast furnace and openhearth employees are working six or seven days weekly.

The manpower shortage, the cancellation of war contracts, and the inability to reach a 40 hr a week work schedule has produced such a financial hobgoblin that steel companies are meeting this week with OPA representatives to present expected operating schedules for the balance of the year in order to prove probable financial loss. Heretofore, OPA has always insisted on experience data and has frowned on future probabilities.

With increasing demand for high-tensile low-alloy steel, a move is reported on foot among users for standardization of specifications by the various producers. This, it is claimed, would facilitate random ordering and simplify engineering practices by users. Because of having plugged the virtues of their respective proprietary products under their own trade names, producers may balk at such a move. However, if consumers sell the idea to their source of supply, there would be few if any bars to interchange of production techniques.

IN the nonferrous field this week it is reported that WPB officials are about ready to release orders restricting authorized uses for lead to an even greater extent than heretofore. Because of the importance of the tin situation, it is reported in some circles that the government may see fit to establish a director of tin operations. The order backlog for slab zinc has dropped sharply.

Reconversion of the machine tool industry appears to be going well. Foreign inquiries principally from France and Belgium are active and machine tool makers are eyeing the possibilities for trade in China.

• **STEEL DRUM RECLAMATION**—Cash savings of $4,555,000 and conservation of 65,000 tons of heavy gage steel have been realized through Quartermaster Corps' reclamation of 1,822,000 55-gal oil and gasoline drums during the first six months of 1945, according to the War Dept. The oil drums were reclaimed through contracts with commercial firms operating under supervision of the Quartermaster Corps. Average cost of this reclamation service is $1.25 per drum, $2.50 less than the $3.75 cost of the new drums. Manufactured from 16-gage steel, and weighing 72 to 74 lb each, the drums reclaimed this year represented the conservation of some 65,000 tons of high priority, heavy-gage steel. In an effort to assure a continued flow of drums (unserviceable and needing reclamation) to the United States, steps have been taken by the Army, in cooperation with the Navy, to return from overseas 55-gal drums for reclamation and reissue.

• **ARMY-NAVY E AWARDS END**—The termination of the Army-Navy "E" Award program, by which the War and Navy Depts. recognized outstanding contributions to the war effort by industrial plants, was announced recently by Under Secretary of War, Robert P. Patterson and Assistant Secretary of the Navy, H. Struve Hensel. Awards granted at the August meetings of the Army and Navy Boards for Production Awards will be presented, but no further meetings of the boards will take place.

• **U. S. STEEL SHIPMENTS**—Shipments of finished steel products by subsidiary companies of U. S. Steel Corp. for August were 1,332,180, compared with 1,608,994 net tons for July, a decrease of 276,814 net tons. August 1945 shipments declined 411,305 net tons, compared with 1,743,485 net tons in August 1944. Shipments for the first eight months of 1945 were 13,066,133 net tons compared with 14,130,864 net tons in the same period of 1944, a decrease of 1,064,731 net tons.

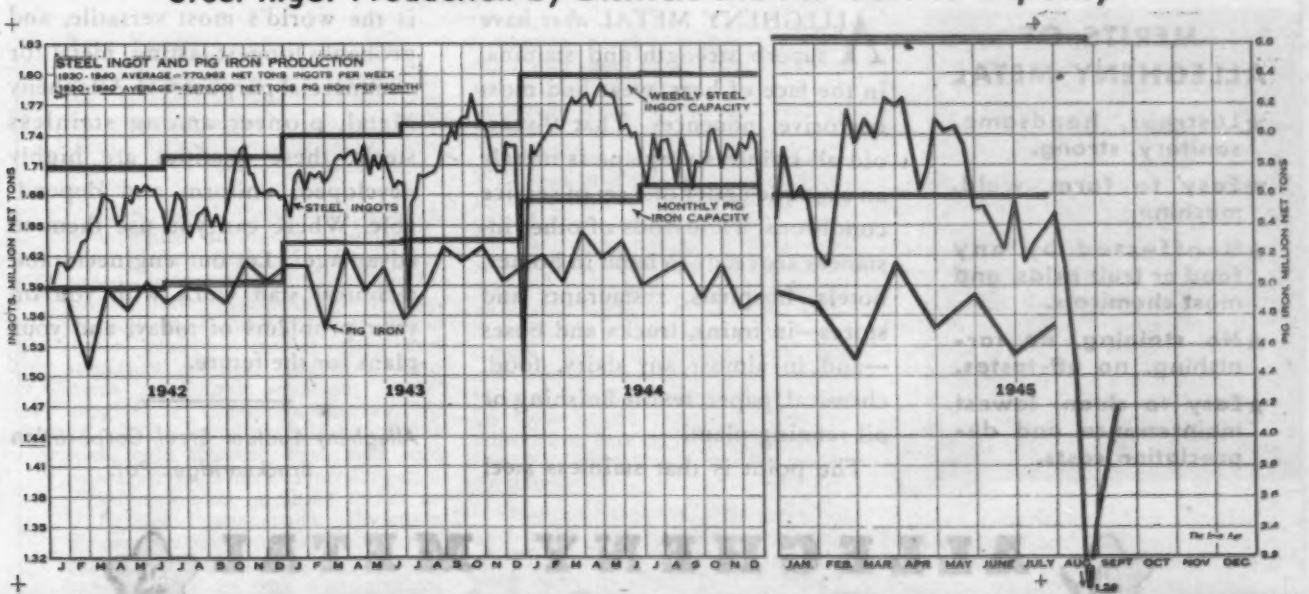
• **MANUFACTURING EMPLOYMENT DOWN**—Due to cutbacks the number of workers in the iron, steel and ordnance industries dropped 17 pct during August, largely after VJ-Day, the Bureau of Labor Statistics, Dept. of Labor announced on Sept. 10. Employment declined 12 pct in the electrical machinery, 9 pct in other machinery and 8 pct in nonferrous metals. The overall reduction in manufacturing employment was 1,600,000 workers or 11 pct of the total, dropping from an estimated level of 13,900,000 to 12,300,000.

• **SURPLUS PLANTS RULING**—Rules governing disposal of government-owned surplus plants through the RFC, were announced by the Surplus Property Board Sept 10. No plants costing more than $500,000 and classified as iron and steel, aluminum, magnesium, aircraft, shipyard, synthetic rubber, aviation gasoline or aircraft, can be sold or leased without prior approval of the SPB. The sale of plants costing more than $1,000,000 must be submitted to the Dept. of Justice for clearance, as required by the Surplus Property Act. These requirements apply to 99.2 pct of all government-owned steel facilities. Under the new SPB Regulation No. 10, no preference is provided for contractors in possession who have been operating the plants for the government during the war.

• **SWPC TO AID SMALL FIRMS**—As the first step in providing small manufacturers and shop operators with an opportunity to modernize their equipment with surplus war property, the Smaller War Plants Corp. is mailing inquiries to some 35,000 small metalworking firms. Two uses will be made of this survey. First—SWPC will try to find in surplus the particular types of machine tools wanted by each small producer and will then notify him where the tools are located. Second—the survey will enable SWPC to plan ahead to help small business by showing the overall demand for the many different types of machine tools. If the small producer wishes to buy a tool that has been located SWPC can lend him money for the purchase, or it may exercise its priority as a government agency to buy this tool for him. The average machine tool in small manufacturing plants is about 15 yr old. Many are more than 30 yr old.

• **MACHINE TOOL OUTLOOK**—The pulse of the machine tool industry is rising. Reconversion of industry as a whole is going well. Foreign inquiries, principally from France and Belgium, are coming in and the possibilities of China, a vast unknown in export equations, are being investigated. Price ceilings are due for a review and shipments, tangibly indexing the excitement, promise to surpass $400,000,000 this year at the present rate. Failure of the government-owned surplus to put in anything like a full-scale appearance dims the present market's roseate glow to something like a tentative beacon en route to normalcy simply because these machines, about which so little is actually known, constitute potential competition until disposition has been made.

Steel Ingot Production by Districts and Per Cent of Capacity


STEEL INGOT AND PIG IRON PRODUCTION
1930-1940 AVERAGE = 770,982 NET TONS INGOTS PER WEEK
1930-1940 AVERAGE = 2,273,000 NET TONS PIG IRON PER MONTH
WEEKLY STEEL INGOT CAPACITY
MONTHLY PIG IRON CAPACITY
STEEL INGOTS
PIG IRON
INGOTS, MILLION NET TONS
PIG IRON, MILLION NET TONS
1942
1943
1944
1945
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
JAN. FEB. MAR APR MAY JUNE JULY AUG. SEPT OCT NOV DEC.
The Iron Age

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
September 4....	64.5*	72.0	74.5	88.5	77.5*	81.5*	75.0	94.0	100.5*	55.0	82.0	84.0	80.0	75.0*
September 11..	75.0	83.0	81.0	88.0	87.5	93.0	75.0	95.0	96.5	56.0	88.0	97.5	80.0	81.0

* Revised

SPECIAL NOTE ON STAMINA...

This all-stainless amphibian, built by Fleetwings, Inc., has flown since 1936 in tropical areas, and has required very little maintenance and no special attention under the most difficult atmospheric and service conditions.

9 YEARS OF SALT SEAS AND TROPIC HUMIDITY HAVE NO EFFECT ON *Stainless Steel*

MERITS OF ALLEGHENY METAL

- ★Lustrous, handsome, sanitary, strong.
- ★Easy to form, weld, machine.
- ★Unaffected by any food or fruit acids, and most chemicals.
- ★No staining, no tarnishing, no off-tastes.
- ★Easy to clean, lowest maintenance and depreciation costs.

ALLEGHENY METAL *does* have superb strength and stamina, in the face of heat, wear and most corrosive influences. That 9-year-old all-stainless seaplane is merely an example under one set of service conditions. Thousands of other instances are ready to hand in homes, hotels, hospitals, restaurants and stores—in trains, trucks and buses—and in almost any dairy, food, chemical, paper, textile finishing or oil refining plant.

The point is that stainless steel is the world's most versatile, and probably longest-lasting, metal for commercial purposes. In Allegheny Metal, pioneer among stainless steels, these qualities are highly developed, uniform and dependable. Where can you use them to advantage? Let our engineers and technical staff work with you on your problems of today, and your plans for the future.

Allegheny Ludlum Steel Corporation
Brackenridge, Pa.

W&D . . . 9949

ALLEGHENY METAL
The Time-Tested Stainless Steel

ALSO HANDLED AND STOCKED BY ALL JOSEPH T. RYERSON & SON, INC. WAREHOUSES

Stainless Base Price Move Boon to Consumers

New York

• • • The single basing point on stainless steel products is dead. It passed away last week when the U. S. Steel Corp established multiple basing points for stainless steel items at their place of manufacture.

On the heels of the Corporation's move other stainless producers, who had used Pittsburgh as the single basing point for their products, made or were making basing points at or near the point of production.

This move will cost steel producers plenty of money, but will substantially reduce the net price of stainless steel to most consumers. The action was not a complete surprise to those who had analyzed carefully the full significance of a recent Supreme Court decision involving the single basing point system.

Last April, the Supreme Court ruled in effect that a single basing point was illegal. That decision upheld a Federal Trade Commission ruling that the use of a single basing point by a corn products company violated the Clayton Act clause, section 2, prohibiting price discrimination.

At that time speculation was rife as a result of this decision as it might ultimately relate to the multiple basing system. More astute observers of

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By THOMAS C. CAMPBELL

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FTC rulings and Supreme Court decisions, however, saw this finding dooming single basing points systems in industry where a given product was made at two or more locations but was based in price at only one point.

Historically, stainless steels, being newcomers when compared with carbon steels, were bound to go through the same trends, pricewise, as the latter. In 1924 the single basing point price for steel products—Pittsburgh plus—was knocked out by a ruling of the FTC. In subsequent years numerous basing points were added by the industry for many products. The same evolution is now taking place for stainless steel.

Like the changes in ordinary steels, however, the most recent change in the marketing of stainless has not necessarily taken place in a single week. Concessions have been given to consumers from time to time which have had the effect of price reductions. Within the past month some companies have shaded extras on stainless and it is not unlikely that freight from the single basing point in the past has been pared down in competitive cases.

An oversimplification of what the move means to producers is as follows:

Steel companies making stainless steels will establish basing points at or near the point of manufacture. When competing in other areas they will use the basing point covering the area in which they are selling.

Where before, the stainless price has consisted of the base price plus the freight from Pittsburgh to the consumer's plant, freight can now only be charged from the nearest basing point. This means a loss in extra freight and an increase in freight absorption for those makers who are far from a consumer's plant and who must pass through an intermediate basing point.

An example would be a Pittsburgh producer selling in the East. He would have to absorb the freight as far as Baltimore which is expected to become a base for many stainless items. On the other hand, when and if Baltimore becomes a base, a producer there who sells in or around that location can only charge the freight from Baltimore instead of the freight from Pittsburgh. This same set of circumstances applies to producers who are near or far away from other basing

New Basing Points Established for Stainless Steel

New York

• • • Below are new basing points for various stainless steel products and the companies which establish them. Other announcements are expected as producers make their decisions.

U. S. Steel Corp. — Pittsburgh base applies on ingots, blooms, billets, slabs, forging billets, hot rolled bars, cold finished bars, sheets, plates and seamless tubing. Chicago base applies on all these items, plus hot rolled strip and structural shapes. The latter two items no longer have any Pittsburgh base. Cleveland base applies on cold drawn wire, cold rolled flat wire, cold finished bars and cold rolled strip. There is no longer a Pittsburgh base on these as far as U. S. Steel is concerned. Obviously if competition has a Pittsburgh basing point for products no longer based there by the Corporation, the Corporation or anyone else will meet this basing price.

Sharon Steel — Makes stainless strip and sheet at Sharon, Pa., base priced at Pittsburgh. Has not announced any additional basing points.

Allegheny - Ludlum Steel Co.— Will base products at point of manfacture. At Pittsburgh will be base priced these stainless steel items: Plates, sheets, hot rolled strip, cold rolled strip, seamless tubing, structural shapes, hot and cold finished bars, and forging billets. At Dunkirk, N. Y., will be base priced cold drawn wire, hot rolled coils, hot and cold finished bars and forging billets. At Watervliet, N. Y., will be base priced hot and cold finished bars, forging billets and forgings. At Detroit will be base priced forgings.

Superior Steel Co.—Produces hot and cold rolled stainless steel strip at Pittsburgh. At this time the only base in effect is Pittsburgh, as in the past.

Universal-Cyclops Steel Co.— Has to change its own policy of limiting its base price to Pittsburgh on stainless steel products. It manufactures stainless steel ingots, billets, forgings, sheets, bars, strip and wire.

Rustless Iron & Steel Corp.—Expects to make Baltimore a base on all items produced there which includes practically all stainless items except flat rolled.

American Rolling Mill Co.—Expects to name Middletown, Ohio, as a basing point for its flat rolled stainless products.

Republic Steel Corp.—Non-committal but will probably name basing points at or near points of manufacture and meet competition elsewhere.

Other Companies—According to the pattern of action already taken, most producers will either keep operating on present base or establish new ones if it favors the company's individual position.

points which have or will be established at such points as Cleveland; Detroit; Pittsburgh; Dunkirk, N. Y.; Watervliet, N. Y.; Middletown, Ohio; and other locations.

To the consumer of stainless steel, the move briefly means that if the savings are passed on to the man on the street, an increased use of stainless steel towards a much greater volume is indicated.

The consumer in Chicago who recently paid the base price plus the freight from Pittsburgh will now pay only the Chicago switching charge on items which are made or based at Chicago. Those consumers beyond the Chicago area will pay freight charges from Chicago instead of freight from Pittsburgh on items based at Chicago. The same general pattern applies to other basing point situations.

Possibly prophetic in the stainless steel move is the speculation that industrial products which have one or a few basing points but which are manufactured at a greater number of locations may be up for scrutiny soon.

Labor Shortages And Repairs Cut Canada's Iron and Steel Output

Toronto

• • • **Sharp reduction** in Canada's iron and steel production was reported for the month of July. Production loss was credited to labor shortage and to the fact that furnaces that had been under constant war time pressure were closed for urgent repairs. Demand for steel continues in excess of current supply in most materials, and the end of the war had not resulted in curtailed demand. Peacetime buying is increasing in volume and steel makers remain uncertain as to delivery against new orders.

Production of steel ingots and castings for July amounted to 229,161 net tons or an average rate of 75.8 pct of total capacity, and compares with 257,115 tons in June when the rate was 85.1 pct, and 234,418 in July, 1944. Output for the month included 220,379 tons of steel ingots and 8782 tons of steel castings.

For the first seven months of this year cumulative production of steel ingots and casting totaled 1,824,779 net tons, which compares with 1,747,001 tons in the like period of 1944 and 1,749,661 tons in 1943.

Pig iron production in July dropped to 150,387 net tons, or 65 pct of capacity against 159,046 tons or 68.8 pct in June, and 166,004 tons in July, 1944. During the month one furnace was banked leaving eight out of a total of 14 furnaces in blast. Production for the month included 121,955 tons of basic iron of which 10,833 tons were for sale and the balance for further use of producing firms; 7668 tons of foundry iron, and 20,764 tons of malleable iron.

For the seven-month period ended July 31, pig iron production totaled 1,092,350 net tons, which compared with 1,115,527 tons in the same period of 1944 and 1,019,158 tons in 1943.

Output of ferroalloys in July amounted to 15,750 net tons compared with 18,473 tons in June and 14,508 tons in July, 1944. The month's output included by tonnage, ferrosilicon, silicomanganese, ferromanganese, ferrochrome, chrome-x and ferrophosphorus. For the first seven months this year production of ferroalloys totaled 114,422 net tons, compared with 105,750 tons in 1944 and 133,201 tons in 1943.

RECONVERSION A LA CARTE: *While the plant was still cluttered with airplane fire walls, remnants of a recently terminated war contract, employees of the Roberts and Mander Stove Co., began assembly kitchen electric ranges. Reconversion is piecemeal, but the important thing is that civilian production is underway.*

Russia Orders 24 Compressors For 500 Mile Pipeline

New York

• • • **The first natural** gas pipeline to be built in Russia, extending from the city of Saratov, in the Ural Mountain gas-producing section, to Moscow, a distance of over 500 miles, will be equipped with American compressors.

This was announced recently by the Export Department of The Cooper-Bessemer Corp., which disclosed that an order for 24 of the company's CMV, 10-cylinder compressors had been placed for early delivery. Each compressor is a 1000-hp unit.

The pipeline, which will have as its primary purpose the transportation of natural gas to furnish domestic and industrial fuel to the Russian capital, will have a capacity of approximately 80 millon cu ft a day.

The compressors will be installed in six booster stations located along the pipeline, each to be equipped with four of the units. The line will be capable of handling a pressure of approximately 800 lb per sq in., which puts it in the category of a high pressure line.

Officials said the order for these 24 compressors is one of the first to be placed directly by the Russian Purchasing Commission in its program of war rehabilitation.

Universal Steel Co. Decision Lowers Tax on Undistributed Profits

Washington

• • • Less stringent government surtax policy on undistributed profits was indicated in a decision of the United States Tax Court handed down recently.

Under the ruling which involved the Universal Steel Co., Cleveland, corporations which prudently refrained from distribution of dividends during war years in order to provide needed capital for future operations and expansion will not be penalized by the surtax on undistributed profits under ordinary circumstances.

The Tax Court, in overruling the Bureau of Internal Revenue's contention that Universal had accumulated an amount beyond the reasonable needs of its business, pointed out that the question involved was whether the dividend policy was prudent in the light of existing conditions or was justified for the purpose of providing additional facilities and maintaining a strong liquid position.

Factors considered by the court in the case, which involved taxes owed by the company for 1941, included a 300 pct increase in business over the preceding year. However, the total leveled off at nearly normal during the next year. The company paid $8000 dividends out of total net earnings for 1941 which amounted to $134,750.

Pointing out that the situation would vary from case to case, the court gave considerable weight to the appellant's contention that it might not otherwise be able to meet its financial demands in view of the war situation. The dividend record of the company had otherwise been consistent, the court pointed out, and the amount retained was less than that needed to meet its financial obligations in the ensuing quarter.

Summing up its view the court said:

"It is our belief that the situation in which the company found itself, considering the ratio of working capital to sales, prospective increases in sales, the reasonable desire and plans for additional facilities, the absence of any history of prior accumulations, the fact that the law does not envision the stifling of normal growth, together with other facts of record, the company acted prudently and has proved that it did permit its earnings or profits to accumulate beyond the reasonable needs of its business."

Under the applicable statute, a surtax is imposed where concerns accumulate earnings and profits in excess of actual needs instead of distributing them. This phase of the tax situation is of particular significance because business generally has been careful in relinquishing wartime capital accumulations through payment of dividends.

Corporations in Mica Industry Indicted In Anti-Trust Violation

Washington

• • • Indictments charging a number of corporations in the mica industry with violations of the Sherman Anti-trust Act have been returned by a Federal Grand Jury in North Carolina, Attorney General Tom C. Clark announced Aug. 29.

Both indictments allege that defendants "have engaged in a wrongful and unlawful conspiracy to fix the terms, conditions and manner" in which the commodities involved are produced and sold in domestic markets. They point out that about 85 pct of the domestic production of sheet mica, about 65 pct of fabricated mica and about 90-95 pct of the production of wet ground mica are controlled by the defendants. North Carolina produces 65 pct of domestic mica which is one of the 23 strategic materials deemed necessary to national security. Mica is particularly essential, it was pointed out, in the manufacture of parts and equipment for telephones, radio, radar, armatures, dynamos, motor vehicles, heating, lighting and air-conditioning equipment.

Companies engaged in producing, processing and selling sheet mica and, also, producing and selling fabricated mica named in the first indictment were: Asheville Mica Co., Biltmore: Land & Mineral Co., Biltmore; Western Carolina Mica Co., Biltmore; A. O. Schoonmaker Insulation Co., Inc., New York; New Hampshire Mica & Mining Co., Keene, N. H.; Connecticut Mica & Mining Co., Portland, Conn.; Eugene Munsell & Co., Inc., New York, and The Huse-Liberty Mica Co., Boston.

The second indictment named the following companies engaged in producing and selling wet ground mica: Richmond Mica Corp., Richmond, Va.; English Mica Co., Spruce Pine, N. C.; Franklin Mineral Products Co., Franklin, N. C.; Concord Mica Corp., Benacook, N. H., and Wet Ground Mica Association, Inc., New York.

LINZ, AUSTRIA, WORKS: *The Iron Works at Linz, Austria, which were blasted by American planes, are being examined by American troops. This plant used about 25,000 slave laborers, mostly French, produced tanks and heavy armament equipment.*

Reynolds Charts Postwar Aluminum Developments

By DAVID P. REYNOLDS

Vice-president,
Reynolds Metals Co.,
Louisville, Ky.

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Louisville, Ky.

• • • The aluminum industry has undergone tremendous changes in the past four years, improvements that directly affect its postwar potentialities. Prior to Pearl Harbor, when aluminum production in the United States was only 329 million lb a year (1939), the Axis controlled most of the world's raw bauxite. Domestic bauxite contained high percentages of silica, an impurity difficult to remove. The United States depended almost entirely upon South America for high grade bauxite but German submarines were taking a high toll of cargo vessels plying between this country and South America.

Confronted with the necessity of fighting a large part of the war in the air and of transporting vast supplies and armaments thousands of miles, lightness of weight became a most important factor in the selection of materials of war. Our military technicians decided that aluminum, though relatively scarce, could and must be produced in large quantities to serve as an answer to this problem. A cutting down of weight, with no sacrifice of strength where it was needed, would impart greater mobility to the products of war and at the same time increase payloads of war materials with a saving of time and cost. Incidentally, the same advantages of weight saving apply quite naturally to a peacetime economy. The peace which is here, is in a sense mobile. Most products will move when in use, and even stationary objects will have to be moved in the process of construction or installation.

In any event, the aluminum industry actually anticipated the government's need for increased production. Old plants increased their output and new plants sprang up almost over night. The industry used whatever high grade bauxite it could get from South America and it used domestic bauxite by developing methods of purifying this ore on its way to becoming alumina.

The obvious and primary need for aluminum was in the construction of fighting aircraft. The aluminum industry met tough production schedules on all military requirements and the latter were constantly broadened. The armed forces wanted aluminum to cut down the weight on gun mounts. It wanted it for rocket launchers, landing mats, mortar base plates, mobile and portable refrigerator units, canteens, pots and pans for the Quartermaster, and warheads for robot bombs. It wanted flexible packaging material and envelopes protected from air and moisture by aluminum foil. It also wanted foil for electronic equipment, to confuse enemy radar, to insulate tanks and the walls of containers in which whole blood was flown from the United States right to the fighting fronts in foreign lands. It wanted aluminum powder for flares and thermite bombs and for durable finishes on field kitchen units.

• • • This is the second of four articles dealing with postwar aspects of aluminum, steel and magnesium. The first appeared on page 129 of THE IRON AGE, Sept. 6. Following this article will be one on steel by Thomas E. Lloyd, Pittsburgh regional news and technical editor.

All of these wants—and thousands more—the armed forces received from an aluminum industry galvanized to action by the war crisis, revitalized by competition that came with the appearance of new arrivals in the field. Never before had a single industry been called upon to meet so many demands and specifications. But all of the demands and specifications were met and by the end of 1943 the nation had increased its annual production of aluminum to 2.3 billion lb.

During this war period, improvements in the quality of aluminum and aluminum alloys kept pace with the increase in quantity which had been brought about by enlarged and improved production facilities and techniques. Chemical and metallurgical engineers developed and perfected new alloys and better processes for increasing the strength and resistance to atmospheric attack in diversified climates throughout the world.

It was realized that the prefabrication of airplane parts would accelerate production, save time and shipping space and speed the reclamation of scrap metal. Wing sections, empennage and fuselage parts for fighters, bombers and flying boats came off the production lines. To meet this new and practical economy of expediting war production, it was necessary for the industry to add to its staffs the positions of design and fabrication engineers. This experience in prefabrication taught the producer of aluminum a good deal he hadn't known about the fabrication of light metal products—what alloys, for example, were best suited for particular applications.

Aluminum is indeed a battle tested metal. In thousands of applications it proved that it could weather the rigors of battle, rough usage and conditions of extreme exposure on land and sea, from the tropics to the Arctic and from ground level temperatures to the sub-zero cold of the sub-stratosphere. Typical of some of the war developed alloys is R301, which is as strong as structural steel and has proved itself in battle as armor plate.

The price factor is also a consideration. The cost of aluminum dropped during the war in spite of a generally high market for other metals. Increased production facilities, less costly manufacturing methods, competition and the discovery of new sources of bauxite point to the possibility of further reductions, though just how much they may be no one now is in a position to say. That aluminum will be plentiful and of excellent quality after the war there is no doubt. An additional reason for this is that sources of high grade bauxite have been located and acquired in Haiti and Jamaica far in excess of the total known deposits of this ore in the United States.

From its achievements born of military emergencies, it follows quite logically that aluminum must play an increasingly important role in the peacetime economy of industry and in the American home.

The weight factor, alone, offers one of the greatest advantages in favor of a wide use of this metal. It is obviously true that lightness of weight is a decided advantage in most products that have to be transported and

in all that are moved or operated manually. It is also true that lightness of weight increases the payloads and speed of properly designed conveyances and decreases their operational and maintenance cost.

In some products, of course, such as locomotives, which must be heavy in order to achieve traction, deadweight is an asset and aluminum, unballasted, will serve as no substitute for the materials now used. However, in the driving mechanism you will find aluminum effectively employed. No one can dispute the fact that where lightness of weight is important, aluminum can be used to advantage in place of most other metals. This, of course, is not to say that other metals and materials, under varying conditions and purposes of use, haven't peculiar virtues of their own for particular jobs. Aluminum, for example, has played a major role in the lightweight construction of war products, but depending upon intended uses, other materials such as plywood, carbon and alloy steels, stainless steel and magnesium, have also been successfully employed.

Far from attempting to detract credit that belongs to various materials, the trend of the present day aluminum industry is to recognize their merit. Reynolds Metals Co. has adopted a policy of cooperation with other industries and expects to achieve a wide use of its own metals in combination with other materials such as steel, wood, paper and plastics.

Reynolds engineers have perfected a new process by means of which thin coatings of aluminum can be applied to steel sheet, resulting in a combination that has the insulating and weather protecting qualities of aluminum as well as the special advantages of steel. This particular blend of metals, if it can be seen, should make ideal roofing material for houses, barns, industrial buildings and construction sheds and should find wide application in outdoor advertising.

Another example of this wedding of materials is Reynalite, a combination of wood and aluminum sheet which will soon be offered to the building industry. It is expected that Reynalite will insulate thousands of homes against summer heat and winter cold and at the same time afford protection against fire, termites, and lightning.

And, while on the subject of building construction, there is no reason why girders as well should not be made of aluminum. Alloys such as R301 or R303, which have all the strength of structural steel, permit erection of higher buildings by decreasing the loads of weight placed on foundations.

The transportation industries, more than all others, will probably claim the largest share of aluminum output in the postwar period. Applications in this field offer advantages of lower consumption of power and more rapid starting and stopping, in addition to greater payloads and faster speed.

The railroad industry has already received the first of 30 boxcars made of aluminum furnished by Reynolds, the first especially designed and approved cars to take full advantage of the attributes of aluminum. As to aluminum's future in the railroad field, it can be pointed out that about 75 pct of the 45,000 passenger cars in the United States are more than 15 years old. Reynolds Metals Co., will soon be in a position to help replace outmoded and worn out equipment. With this in mind, company railroad engineers have designed streamlined aluminum cars and less-than-carload shipping containers that can be carried on flat cars and transferred intact to freight airplanes, ships or trucks. An aluminum refrigerator car which will be about 18,000 lb lighter than standard cars of the same dimensions, has been designed by Reynolds. A feature of all of these designs is a lowered center of gravity which will contribute to faster speed and stability on the rails.

With all of the advantages aluminum has to offer, it is quite possible that in the not too distant future automobiles will be built almost entirely of this metal. As it is, many parts of these vehicles, such as frames, motor castings and pistons are, and will be, made of aluminum. The same holds true of trucks and trackless trolleys. As for buses, the highways are being traveled by all-aluminum jobs and indications are that this metal will be the industry's first choice in the postwar era.

With the war ended, aviation will turn its attention to helicopters, small family craft, passenger planes, and giant cargo carriers. If predictions are correct, long distance commuting by air will be comparable to a ride in a subway or taxicab. The aluminum industry is prepared to furnish the metal for all of these developments. And, with regard to subways, the aluminum industry can and probably will furnish the metal for underground cars.

Aluminum has always been ideally suited for use on land and in the air and for a number of years has been giving satisfactory service for navy seaplanes and flying boats. The technique and experience gained in these applications should prove of value to the manufacturers of surface vessels who have not used aluminum extensively up to now. It may be some time before large vessels are made entirely of aluminum. However, aluminum has gone into superstructures and furnishing of vessels in considerable quantities, with the result that cargo capacity has been increased by saving weight where it was not needed.

Postwar Anticipated Aluminum Consumption

• • • In a hearing before the Senate Small Business Committee on Feb. 28, 1945, R. S. Reynolds, president of Reynolds Metals Co., indicated that after full peacetime reconversion had taken place, he expected aluminum to be used in approximately the following amounts by the various industries named:

Railroad:

1,000,000 lb of aluminum per year for 100,000 freight cars.
35,000,000 lb of aluminum for every 1000 passenger cars built, with an anticipated 300 aluminum passenger cars per year, or 10,500,000 lb per year.

Automotive:

120,000,000 lb of aluminum per year consumed by truck and bus manufacturers.
400,000,000 lb of aluminum per year for 5,000,000 passenger cars.

Construction:

"Hundreds of millions of lb" of aluminum, the exact amount depending upon the price, nature of competition, and aggressiveness in demonstrating the merits of aluminum.

Broad Peacetime Economy Program Mapped by President and Sent to Congress

Washington

• • • Aimed at reestablishing an expanded peacetime industry, trade and agriculture in the quickest possible time, a 24 point legislative program was given Congress by President Truman on Sept. 6.

Met with diversified reactions, the message set eight initial goals to be achieved as quickly as possible during the transition period of "great emergency": (1) Demobilization of the armed forces no longer needed; (2) Cancellation and settlement of war contracts; (3) Clearance of war plants to permit peacetime production; (4) To hold the line on prices and rents until competition can operate to prevent inflation and hardship on consumers; (5) Removal of all possible wartime controls so as to encourage reconversion and expansion; (6) Retention of controls aiding reconversion by preventing bottlenecks, material shortages; (7) To hold the line on wages to the extent necessary to stifle inflation; (8) To prevent rapid decreases in wage incomes and purchasing power.

Urgently recommending that the Congress enact broad and comprehensive housing legislation, the President stated that such a program would provide opportunity for private investment of from $6 to $7 billion dollars annually. The President added that it would provide an impetus for new products and would go a long way in developing new markets.

The President strongly recommended that legisaltion be enacted to acquire and retain stockpiles of materials in which we are naturally deficient but which are necessary for national defense.

The Fair Labor Standards Act of 1938 should be amended, the President said, by substantially increasing the minimum wage specified to a level which will eliminate substandard of living, and assure maintenance of health, efficiency and general well-being of workers.

Speaking of government controls, the President stated that it will still be necessary for price enforcement agencies to resist unreasonable pressures for higher prices on some commodities the same as during the war. It will similarly be necessary, he said, for the government to resist pressures for increased wage rates likely to imperil price ceilings.

In asking for full-employment legislation, the President defined it as meaning "the full employment for all under the American economic system —nothing more and nothing less."

Extension of the Second War Powers Act was asked by the President who pointed out that most of its provisions expire Dec. 31, 1945. Orderly transition to a peacetime economy, he said, will require some of the controls contained in the act after that date.

Congress was urged by the President not to adopt as yet a resolution proclaiming termination of the emergency or cessation of hostilities. Such a resolution, he said, would automatically cause the death of many war powers and wartime agencies before we are ready.

Stating his awareness of the vital role to be played by taxes during reconversion, the President urged enactment of a new tax bill aimed principally at removing barriers to reconversion and to the expansion of our peacetime economy.

President Truman also called upon the Congress to establish a single Federal research agency which would discharge the following functions:

(1) Promote and support fundamental research and development projects in all matters pertaining to the defense and security of the nation. (2) Promote and support research in the basic sciences and in social science. (3) Promote and support research in medicine, public health and allied fields. (4) Provide financial assistance in the form of scholarships and grants for young men and women of proved scientific ability. (5) Coordinate and control diverse scientific developments now conducted by the several departments and agencies of the Federal Governments. (6) Make fully, freely and publicly available to commerce, industry, agriculture and academic institutions the fruits of research financed by federal funds.

Small business, the President said, should continue to get the necessary help and protection from the Congress. Assistance should be given, he said to enable small business to obtain adequate materials, private financing, technological improvements and surplus property.

Commenting on the more expeditious disposal of surplus property and plants under a single administrator rather than a three-man board, the President said that plants and equipment should be disposed of by sale or lease on a basis that is fair to industry and to the government.

Legislation creating a surplus property administration under a single administrator instead of the three-man board was passed by the House on Sept. 10. The bill now goes to the Senate for approval, which is expected shortly.

President Truman requested the change to assure effective performance of the surplus disposal job.

FAREWELL TO A WAR JOB: *His war job suddenly ended and no peacetime job in view, Claude Smith (center) starts for Florida with his wife and their two-month old son in their trailer. They went to Detroit from St. Louis to take a war job. Here they are saying goodbye to their Detroit neighbors.*

Light-Metals Plants Disposal Plan Presented

Washington

• • • Dealing specifically with the disposal of government-owned light-metals plants, by SPB, an 18-point program was presented on Sept. 10 to Senator James E. Murray, Democrat, chairman of the Senate Small Business Committee by the Surplus War Property Subcommittee of which Senator Tom Stewart, Democrat of Tennessee, is chairman. Many of the basic principles involved in the program, it was pointed out, also are applicable to other government-owned plants, which may, as a result of the end of the war, be sold to private industry for peacetime operations.

Senator Murray explained that it is the expressed intention of the Congress that plant disposal should be made in such manner as to foster competitive enterprise. Senator Stewart declared that Alcoa still controls 86 pct of the nation's privately-owned aluminum capacity, and Reynolds Metals, 14 pct. The latter company was said to be "able and aggressive competition" but "too new in the industry to have demonstrated how extensive will be its competition." The Dow Chemical Co., he added, is the largest major factor in the magnesium industry. Never in the history of the United States, the Tennessee Senator said, has there been so great an opportunity for the government to facilitate the growth of American competitive enterprise.

The 18 points summarized in the subcommittee report call for the following action:

1. That the Surplus Property Board sponsor a unified government program for the disposal of light-metals plants in accordance with the Surplus Property Act.

2. That as a part of this program, the Dept. of State and the Foreign Economic Administration be requested to negotiate for bauxite supplied to be delivered to the United States under settlements of lend-lease obligations, and that such supplies be stockpiled or converted into metals according to the recommendations of the Army-Navy Munitions Board, and any surplus over such requirements be offered for sale to American aluminum producers. That the Surplus Property Board request appropriate government agencies to make accurate surveys of bauxite reserves in the United States and those deposits in other parts of the Western Hemisphere and on lands taken from Japan by our military forces, with the purpose of providing access to such bauxite reserves to American aluminum producers lacking sufficient ore reserves.

3. That the Surplus Property Board cooperate with other government agencies in coordinating stockpiles of bauxite, aluminum and magnesium for national defense with government purchases of output in such manner as to aid in disposal and operation of surplus government plants.

4. That the government-owned stockpile of bauxite at Hurricane Creek, Ark., be treated as a facility of the Hurricane Creek alumina plant and used to supply American aluminum producers with bauxite or alumina until such time as they can arrange for their own supplies, and at the same time, that the Reconstruction Finance Corp. reduce the price of alumina manufactured at the Hurricane Creek plant so that they will yield an operating profit of not more than 5 pct and return on investment of not more than 2 pct.

5. That Reconstruction Finance Corp. contracts for operations of government-owned semi-commercial alumina plants be continued until private enterprise determines which plants, if any, it will take over and that the remaining plants be turned over to the Bureau of Mines for operation, expansion or maintenance, according to the best interests of national defense.

6. That the existing duty on bauxite imported into the United States be repealed and that the surplus property board request the Tariff Commission to make a study of comparative costs of aluminum production and fabrication in Canada and the United States and make recommendations with respect to the fairness of the present duties on aluminum metal and fabricated and finished aluminum products.

7. That the Surplus Property Board issue regulations for the accumulation and disposition of secondary and scrap aluminum and magnesium owned by the government at home and abroad, including war scrap, airplanes condemned to be scrap, government-owned industrial scrap, inventories and other forms, with the purpose of encouraging new and larger long-term uses of light metals.

8. That the Surplus Property Board, with the aid of the Federal Power Commission, make a study of present and potential electric supply costs and rates for the light metals industry of the United States.

9. That the Surplus Property Board adopt various steps to speed up the disposal of surplus light-metals plants, including a policy calling for the prompt declaration of such plants surplus as soon as possible after war needs have been met.

10. That the Surplus Property Board study and report its recom-

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DUTCH ADANO: *Among the collection of over 5000 church bells in dumps in Germany, formerly destined for the Reich war machine, is this specimen from a Dutch church.*

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mendations on the following subjects to Congress:

A. Methods for conducting government-financed research and for dissemination of findings relative to processes, uses and markets for light metals.

B. Methods by which government laboratories and other public and private institutions may cooperate in the extent to which idle equipment in government-owned light-metals plants may be employed to demonstrate processes and uses of light metals.

C. Methods by which patents, technical processes and know-how may be made available upon fair terms to all producers.

Light metals productive capacity was enormously increased during the war. It now exceeds 3 billion lb annually and is more than 7 times the aluminum production and 80 times the magnesium production of 1939. The government owns 1,340,000,000 lb capacity of the total of 2,350,000,000 lb aluminum capacity. Alcoa owns 850,000,000 lb capacity and Reynolds 16,000,000 lb capacity. The 1944 magnesium capacity is 586,000,000 lb of which 36,000,000 lb is owned by Dow, 24,000,000 lb by Kaiser's Permanente and 526,000,000 lb by the government. The prewar peak production of magnesium in 1939 was 7,000,000 lb, Dow being the only producer.

The total government investment in aluminum and magnesium plants exceeds $1,000,000,000. Alcoa has already written off $150,000,000 and its assets, the report said, have increased in four years from $293,000,000 to $474,000,000. The assets of Reynolds in the same period have expanded from $32,000,000 to $89,000,000 and of Dow from $48,000,000 to $140,000,000.

RFC Cancels All Alcoa Smelting Plant Leases

Washington

• • • Acting upon the recommendation of SPB, the RFC recently announced that effective midnight it will take over government-owned aluminum plants and related facilities which have been operated by the Aluminum Co. of America. The plants, RFC said, will be disposed of so as to create competition in the aluminum industry in accordance with a court decision.

Terminating its lease agreement with Alcoa, RFC said it would take over plants and facilities at Jones Mills, Ark.; Los Angeles; Massena, N. Y.; Spokane, Wash.; Frontdale, Ore.; and plants at Hurricane Creek, Ark., and Baton Rouge, La.

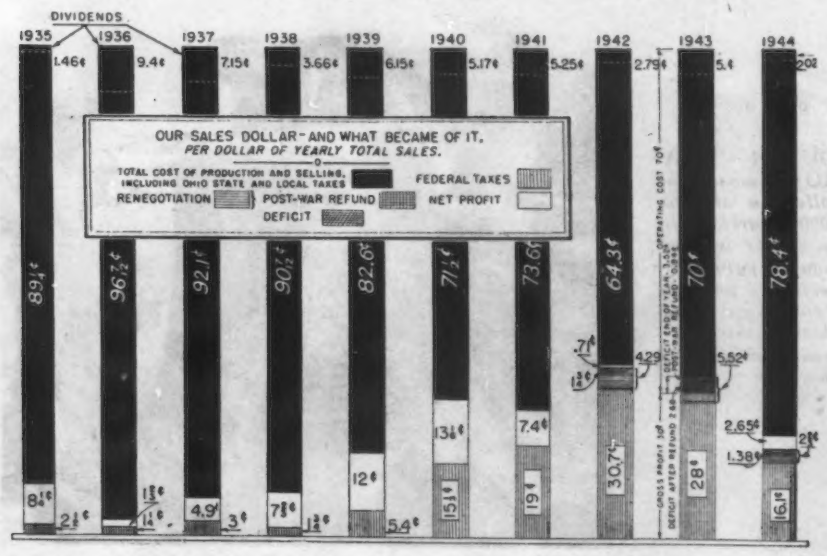
RFC pointed out that under the lease Alcoa would have been in control of the plants until various dates late in 1947, and throughout 1948.

"It would, therefore, have been impossible to make immediate arrangement for the sale or lease of the plants to others so long as the lease was in effect," RFC said. "The lease was terminated for the purpose of freeing the plants from the Alcoa agreement so that they could be disposed of in a manner which would create competition in the aluminum industry. The government agencies concerned have taken this course in an effort to conform to the recent decision of the United States Circuit Court of Appeals for the Second Circuit and to provide additional sources of supply of this material so essential to the national security."

RFC released a letter addressed to Arthur V. Davis, chairman of Alcoa, and which accompanied the notice of termination.

The notice of termination sent to Alcoa offered to make an arrangement whereby Alcoa would be permitted to continue to operate any or all of the plants for one year, commencing Sept. 1, 1945, upon the terms and conditions of the existing lease, except that the arrangement could be terminated on 60-days written notice of either party. This offer was made, RFC said, in the hope that in the interests of maintaining employment it would be possible to arrange for the operation of the plants by Alcoa on a temporary basis. Alcoa has informed representatives of the RFC that it is not interested in making an arrangement of any kind for the temporary operation of these plants.

• **CORPORATE INCOME TREND: Wartime diminishment of profits, swallowed up by increased costs and taxes, is graphically shown in the above chart prepared for its own use by a midwestern machine tool manufacturer. Interesting is the fact that the years 1942 and 1943 were probably the biggest volume years in the company's history, but showed the smallest profit during the 1935-44 period and the only loss. Like other companies in its field, the firm is wondering today whether elimination of wartime excess profits taxes will aid it very much in the face of the war-created oversupply of machine tools.**



RFC Offers Eight Plants

Washington

• • • RFC has put on the market for sale or lease eight modern plants with equipment which have been operated by the following companies: Rever Copper Co., Baltimore; Howard Aircraft Corp., St. Charles, Ill.; Studebaker Corp., Fort Wayne, Ind.; Consolidated Vultee Corp., Miami Springs, Fla.; American Broach & Machine Co., Ann Arbor, Mich.; Republic Aviation Corp., Evansville, Ind.; Alan Wood Steel Co., Ringwood, N. J.; Oilgear Co., Milwaukee.

WPB Relaxes Import Control

Washington

• • • WPB has removed copper and iron and steel scrap from import control. Among materials that remain subject to import control are chrome ore, manganese ore, industrial diamonds and corundum.

Government-Industry-Labor Face Mutual Responsibilities

Washington

• • • Mutual responsibilties facing industry, labor, government and Congress during the reconversion period were given considerable emphasis by spokesmen of organized labor and government in addresses.

Speaking on Labor Day in behalf of organized labor, William Green, president of the AFL, Philip Murray, president of CIO and Secretary of Labor L. B. Schwellenbach acting as government spokesman, have made it unmistakably clear that close cooperation must continue to exist between labor, management and government if orderly reconversion and full employment are to be achieved.

Discussing the unfinished business on hand, Secretary Schwellenbach reminded labor that every right has a corresponding responsibility. The goals to be achieved are indivisible, he said, urging union members and leaders to be constantly aware of their responsibilities and the opportunities to be gained in achieving those goals. In accepting its responsibilities, labor surrenders nothing but gains broader opportunities based on firmly planted legal rights, the Secretary said.

A prerequisite of full employment —the opportunity to work for every person who wants work—is full production of goods and services, he pointed out.

"We cannot have full production unless we have full consumption and we will have none of these—full employment, full production or full consumption—if our productive machine is stalled and our power to consume diminished by chaotic industrial relations," Secretary Schwellenbach said.

Problems confronting labor and industry must be handled by individuals, groups and local communities, he said, for they cannot be solved by a few people in Washington where only general principles may be agreed upon and general policies enunciated. The real answers to the day-to-day problems of industrial relations, Secretary Schwellenbach declared, are to be found in plants and communities.

Warning that if labor does not assume its responsibilities, the government will be invited and even compelled to assume them, the Secretary pointed out that management had surrendered its rights and opportunities by practices which brought demand for regulation and ultimately forced the government to assume authority.

In addition to requests for wage increases to compensate for loss in take-home pay, both Mr. Green and Mr. Murray suggested that Congress follow a program which included passage of the Full Employment and Kilgore-Forand Unemployment Compensation Bills, adoption of the Pepper Bill which calls for minimum wage of 65¢ an hr in interstate commerce and enactment of the Wagner-Murray-Dingell Bill which would broaden the scope of the Social Security Act.

Mr. Green also asked for accord at the labor-management conference called by President Truman, best efforts on the part of industry and government in speeding reconversion, a shorter work week to provide greater employment and passage of the Wagner Act which calls for a 10-year housing construction program.

Other recommendations made by Mr. Murray included establishment of a permanent FEPC, abolition of the poll tax, tax revisions to provide relief in the lower income brackets so as to accomplish the greatest good for the greatest number, rather than the greatest protection for the few. He also called for prompt action along the lines of a public works program to provide roads, schools, housing and regional projects such as the Missouri Valley Authority.

"We stand at the threshhold of a new industrial revolution, perhaps more sweeping in its effects than the advent of the machine age and electric power," Mr. Green said while commenting on atomic energy. He added, "Even in our own day and with existing facilities we can and must raise the American standard of living by at least 50 pct."

The AFL does not share the pessimistic views of the prophets of who see nothing but gloom and discouragement ahead, Mr. Green stated repeating the oft used phrase of the late President Roosevelt "—we have nothing to fear but fear itself."

Emphasizing that a return to the "good old days" will not satisfy the American people, Mr. Green stated that one of the next steps in raising living standards progressively higher is to master the problem of distribution.

"By sustaining full employment at high wages, private industry can put enough purchasing power into the hands of the Americain people to buy what industry can produce," he added. "That is the only sure way private industry can save itself and the system of free enterprise."

War production in American factories which saw an eleven-fold increase from 1941 to a monthly total of $5½ billion proved to be the decisive factor in victory, Mr. Green said in outlining the accomplishments of labor in the last four years.

Welcoming servicemen and women returning from overseas, Mr. Green pledged the help of the AFL to obtain them good jobs and make a new start.

Mr. Murray expressed the opinion that the American people would not see $15 billion worth of publicly financed industrial plants lying idle and, if faced with adverse economic conditions, will look to the government to see that those plants are operated and put to production of the goods and services we require.

The decision whether to use the productive capacity built up by our people and financed by taxes or to let it rust and decay, must be taken with utmost speed, Mr. Murray emphasized.

The highest possible level of purchasing power must be maintained, he urged, and both industry and government should recognize the need of doing it not only as a responsibility but as an obligation. There must, he said, be an upward adjustment of the general wage level to compensate the working population for the loss they have sustained by heavy cuts in weekly take-home pay.

To make up for the loss in take-home pay, the CIO International Committee on Wages met in Pittsburgh on Sept. 11, to map the new drive for increased wages in the steel industry. The details of this meeting have been forthcoming as yet but an outline of the demands of the union that will be made upon the steel industry are expected shortly.

Chicago Employment Declines

Chicago

• • • Employment in manufacturing industries here continued its steady decline in July, Chicago Association of Commerce figures show. The index for employment in manufacturing industries dropped to 132.0 from 138.2 in June and 154.0 in July, 1944. The factory payroll index declined to 258.3 from 275.4 the preceding month and 294.6 a year ago. Both indexes have declined each month this year. The peak for the employment index was 163.2 in November and December 1943, and for the payroll index 304.4 in December 1944.

Industrial Briefs . . .

• ROSIN PLANT — Newport Industries, Inc., Pensacola, Fla., plans to install new production facilities as rapidly as engineering and construction can be completed. Contracts have already been let with the Stone & Webster Engineering Corp. for the engineering and construction of a new Newport plant to be erected at Oakdale, La., at an estimated cost in excess of two and a half million dollars. The first unit of the plant will have a capacity equivalent to a daily output of 175,000 lb of rosin, 3700 gal of turpentine and 2200 gal of pine oil.

• NEW OFFICE—To render better service to the mines and industrial plants in the West Virginia territory, Robins Conveyors, Inc., and its affiliate, Hewitt Rubber Corp., have opened a new office in the United Carbon Bldg. in Charleston, W. Va. R. U. Jackson will be in charge of the office, assisted by H. N. Kepler.

• MOVES BRANCH OFFICE—Vascoloy-Ramet Corp., North Chicago, Ill., has moved its Detroit branch office to 512 Book Bldg. The Detroit branch carries a full line of standard carbide and Tantung tools and blanks. The branch office of the Fansteel Metallurgical Corp., an affiliated company, is maintained at the same address.

• LAST B-29 ENGINE — The Dodge Chicago plant of Chrysler Corp. has completed its last B-29 aircraft engine for the Army Air Forces. Dodge Chicago was turning out 1700 engines a month before the end of the war, and termination provisions provided for completion of all engines on the assembly line.

• FACTORY BRANCH — The Lincoln Electric Co., Cleveland, has announced the opening of a direct factory branch sales office in St. Louis under the direction of Mr. R. J. Brugge as welding engineer and district manager of sales and service.

• OPENS OFFICE—Methods Engineering Council, Pittsburgh, has announced the opening of an Eastern div. office in New York City, with L. O. Sweval as manager.

• NEW PLANT—Plans for the erection of a manufacturing plant near Elyria, Ohio, have been announced by General Motors Corp. The plant will be occupied by a new division which will produce products similar to those produced in Syracuse, N. Y., pre-war. The plant will include 400,000 sq ft of manufacturing floor space and an administration building.

• CHANGE IN ADDRESS — The Detroit office of the Geometric Tool Co. Div. has been consolidated with the Detroit plant and office of the Greenfield Tap & Die Corp. located at 5850 Second Blvd., Detroit.

• EXPANDING — Square D Co. plans to double the size of the present plant in Milwaukee. The Milwaukee operation is devoted to industrial electric motor control and other electrical equipment.

• TO BUY PLANT—Perkins Machine & Gear Co., West Springfield, Mass., is negotiating with the government for the purchase of all or part of the Navy-owned plant adjacent. During the war the company employed about 1800, but the payroll since then has shrunk to 300.

• DIESEL SHOP — New Haven Railroad will erect a diesel locomotive maintenance shop at New Haven to cost $675,000. WPB has granted permission for materials and machine tools.

• ASSEMBLY PLANT — General Motors Corp. has under consideration the construction of a one-story assembly plant in Framingham, Mass., to serve the New England and export trade. Plant will require 5000 workers.

Timken Co. Volunteers 10 Pct Wage Increase For All Employees

Canton, Ohio

• • • **William E. Umstattd,** president of The Timken Roller Bearing Co., announced today a 10 pct increase in the base pay of all its employees based on a 40 hr work week which has been reinstituted by the company. The increase, he said, would apply to all salaried employees and to all those covered in the company's union contract.

The increase on the 40-hr week basis must be approved by Philip Murray, CIO president, Umstattd said, in disclosing that he had written President Murray asking for his endorsement. Should Mr. Murray approve, Mr. Umstattd said, the increase for about 16,000 Timken employees in eight Ohio plants, as well as in 17 branch offices throughout the country and Canada, will total about $4,000,000 annually.

The company has two plants in Canton, Ohio, two in Columbus and others in Wooster, Mt. Vernon, Zanesville, and Newton Falls, Ohio.

In announcing the plan, Mr. Umstattd said, "Company officials hope the pay increase will help business conditions and will give our employees a fair 'take home pay.' Timken hopes it will be able to keep its employees busy and at the same time hopes the administration does not reduce tariff another 50 pct and allow the United States to be smothered with Swedish steel and bearings produced at labor rates less than one-half those paid American workmen."

Mr. Umstattd said Swedish steel and bearing leaders already are seeking to "dump large amounts of steel and bearings in American markets." He also said recent tariff legislation permits a maximum 50 pct reduction on tariff on foreign steel and bearings, "on top of an allowable peak a 50 pct cut established by the Roosevelt Administration in 1935."

Timken had no V-J day layoffs and at present there are immediately needed 400 additional skilled and unskilled employees in Canton alone, and about 300 more in other Timken plants. In about six to nine months, after the present economic transitional period has passed, Timken believes that its employment roll will be increased from a present 16,000 to approximately 20,000.

War Dept. Contracts Now Being Let By Competitive Bidding

Washington

• • • Turning from the wartime practice of letting contracts on a strictly negotiated basis, the War Dept. now has switched to a peacetime policy of competitive bidding, except in instances where it considers there is no real competition reflected in bids. In the latter cases negotiation will continue.

In announcing that it had resumed the practice of competitive bidding, the War Dept. said that the change has been made possible because of the tremendous drop in Army procurement, the relaxation of delivery schedules and the consequent increase in competition for business.

Where there is competition for War Dept. procurement, the chief of the technical service involved will advertise and solicit quotations. All requests submitted to contractors will state that while the award of a particular contract will normally be made to the lowest qualified bidder, the War Dept. reserves the right to award the contract as the result of negotiation and to reject any or all bids.

If the price is fair and reasonable and the bids received indicate the effect of competition, the award will be made to the low bidder and no detailed analysis of estimated cost will be needed. No further negotiation will be necessary under such conditions. However, if no real competition is reflected in the bids, if an insufficient number of contractors submit bids, or if prices bid are excessive as compared with earlier prices, an analysis will be necessary and negotiation will continue. This practice will also be followed if Army procurement requirements absorb a substantial portion of the capacity of an industry or if requirements are placed with a sole source, as in research and development contracts. If bid prices indicate that the contractors are deliberately pricing themselves out of government business in order to handle civilian business, the same procedure will be followed.

All contracts, except those relating to civil projects under the Chief of Engineers, will be awarded under the First War Powers Act and Executive Order No. 9001, and the Act of July 2, 1940, as continued in effect by the Act of June 5, 1942.

Foreign Briefs . . .

• CHILE — Further details on the iron and steel plant to be erected near Concepcion by the Corporacion de Fomento de la Produccion with the assistance of American capital have been announced. It will have an annual capacity of 100,000 tons of finished products, or about two-thirds of Chile's normal consumption of these products. According to present plans, operations will commence in late 1945 or early 1946. Equipment will be installed to roll reinforcing steel, light structural shapes, thin plates and shapes, strip for welded pipe and wire drawing. The Corporacion de Fomento de la Produccion has acquired a sheet mill from the Worth Steel Co., Claymont, Del. Other equipment will include two 100-ton electric furnaces of the Swedish Tysland-Hole type, which will be supplied with current from one of the hydroelectric plants to be erected. High grade ore is available from the El Tofo region of North Chile. In addition there will be a bessemer converter, a mixer and by-product coke ovens.

• VENEZUELA—Iron ore deposits in Venezuela are to be exploited as soon as a plant is available. Reserves are estimated at between 60 and 100 million tons, much of which can be mined without stripping.

• BELGIAN CONGO — According to *Iron and Steel*, a report issued by the Union Miniere de Haut Katanga concerning its activities during the period of the war states that the company installed two electric furnaces for working up cobalt concentrates at the Kobolela mine. A new cobalt mine was opened up and an ore treatment plant installed and operated at Kamoto, in the Western group. A cobalt recovery plant and plant for the production of electrolytic cobalt was set up at Jadotville.

• SPAIN — Output of iron in Spain in 1944 amounted to 570,000 tons, as compared with 543,000 tons in 1943. Production of steel amounted to 665,000 tons in 1944, as compared with 656,000 tons in 1943. The decline in the production is attributed to the shortage of coal and coke. Despite increases in prices, it was not possible to balance increased costs of production.

• U.S.S.R.—Rich nickel deposits are reported at Nivalo, near Petsamo, in the region ceded to Russia by Finland after the Finno-Russian War. These are to be investigated further with a view of their exploitation. Unusually rich niobium ore deposits are reported to have been discovered in the Vishnevi Mountains, where a shaft has already been sunk for their exploitation.

• BOLIVIA—The Republic of Bolivia has awarded a $9,500,000 road building contract to Compania McGraw-Warren Bros., S. A. The new highway, 250 miles long and 16 ft wide, will be asphalt surfaced and is designed for maximum traffic of 50 miles per hr. It will be the main transportation artery between Cachabamba and Santa Cruz, two districts which hitherto have been linked only by air. The engineering and design are being done by personnel supplied by the U. S. Public Roads Administration. The work will be partly financed by the Export-Import Bank of Washington, which is extending a loan to the Bolivian Government. Construction is to begin immediately and it is expected the road will be completed in about three and a half years. F. H. McGraw & Co. of Panama have been made engineers and architects for a $7,000,000 air terminal for the Republic of Panama.

SPB Rules for Plant Disposal Permit Below-Maximum Price Awards

Washington

• • • **Rules governing** disposal of government-owned surplus plants through RFC, were announced by the Surplus Property Board Sept. 10.

No plants costing more than $500,000 and classified as iron and steel, aluminum, magnesium, aircraft, shipyard, synthetic rubber, aviation gasoline or aircraft, can be sold or leased without prior approval of SPB. The sale of plants costing more than $1 million must be submitted to the Dept. of Justice for clearance, as required by the Surplus Property Act.

Under the new SPB Regulation No. 10, no preference is provided for contractors in possession who have been operating the plants for the government during the war.

To achieve the basic aim of speed in disposing of surplus plants, the regulation provides that the disposal agency, "should seriously consider offers to purchase or lease which will result in a lower monetary return if the applicable objectives of the act will be better attained thereby."

RFC has been authorized to accept offers from responsible local groups with adequate working capital and other necessary qualifications and to extend liberal credit terms over a period of years, in preference to a cash offer from a firm or group that would tend to concentrate economic power.

The pricing policy established under the regulation provides that the selling price shall be arrived at by negotiation and shall be determined by actual proposals received and by consideration of the use of the property most desirable in the light of the objectives of the Surplus Property Act. In appropriate cases, sales by sealed bid are permitted.

Transfers of industrial property to government agencies, in accordance with the Surplus Property Act, are to be made at "fair value." To carry out this provision, the board also issued a Special Order No. 19, which gives the formula for determining the so-called "fair value." This is defined as the price that a well-informed, typical buyer would pay if he were purchasing the property for a profit-making purpose. In estimating the fair value, only such rights in land, buildings, and equipment that would be of use to such a buyer shall be considered. In sales to other than government agencies, plants may be sold at less than the fair value if it would further the "social objectives" of the Surplus Property Act.

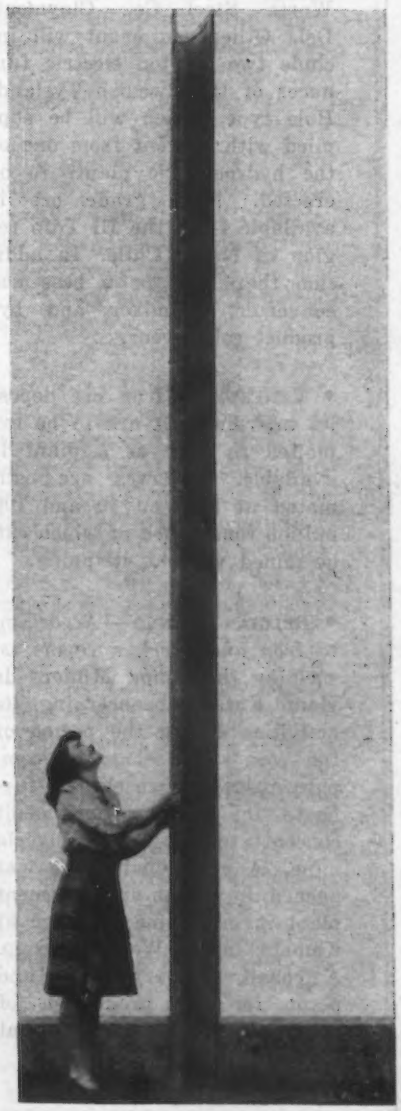
In the case of facilities in which the government owns only a part of the plant or equipment, the possibility of converting the government-owned share into a unit capable of independent operation must be studied. The feasibility of subdividing plants for multiple tenancy or joint use by more than one small business will also be considered.

The regulation provides that each purchaser must certify that he is acquiring property for his own use and not for resale or lease. No plant or part of a plant, excepting the government-owned portion, can be dismantled or moved without first giving 30-days notice to the government of the state and municipality in which the property is physically located. This is intended to protect local communities against the loss of employment from removal of war-acquired industry.

Further aid is given small business and veterans by granting the SWPC the power to purchase plants under its priority for resale or lease. First priority is granted to all government agencies and second to state and local governments. Those priorities may be exercised any time before the property is sold.

In certain categories, the government holdings represent the dominant part of entire industries. Synthetic rubber plants, for instance, represent 98 pct of that industry's capacity. The government also owns 90 pct of aircraft, 90 pct of magnesium, and 55 pct of aluminum productive capacity. Government-owned steel producing facilities account for 8 pct of total productive capacity.

RADAR HOUSING: *According to a report this is the largest molded plastic product ever produced. The radar housing, for Douglas aircraft, is 17 feet long.*



Canada Shipbuilding Operations Halted

Toronto

• • • **Shipbuilding operations** in Canada have been sharply curtailed as a result of cancellation of orders by the Canadian and British governments, and cancellations also affect ships that were under construction. A report on Vancouver, B. C., three shipyards states that workmen now are engaged with acetylene torches cutting up for scrap the 345 ft. hulls of six ships which had been ordered by the British Admiralty for war use, at a cost of about $12,000,000.

Two of the vessels, transport ferries, were within two weeks of launching when the order was received to stop work. Each hull contains approximately 1500 tons of steel which may be turned over to War Assets Corp., for disposal. Orders also have been received to "burn" for scrap two more transports on the ways at North Van Ship Repairs. When the job is finished War Assets Corp., will have 9000 tons of scrap steel for disposal.

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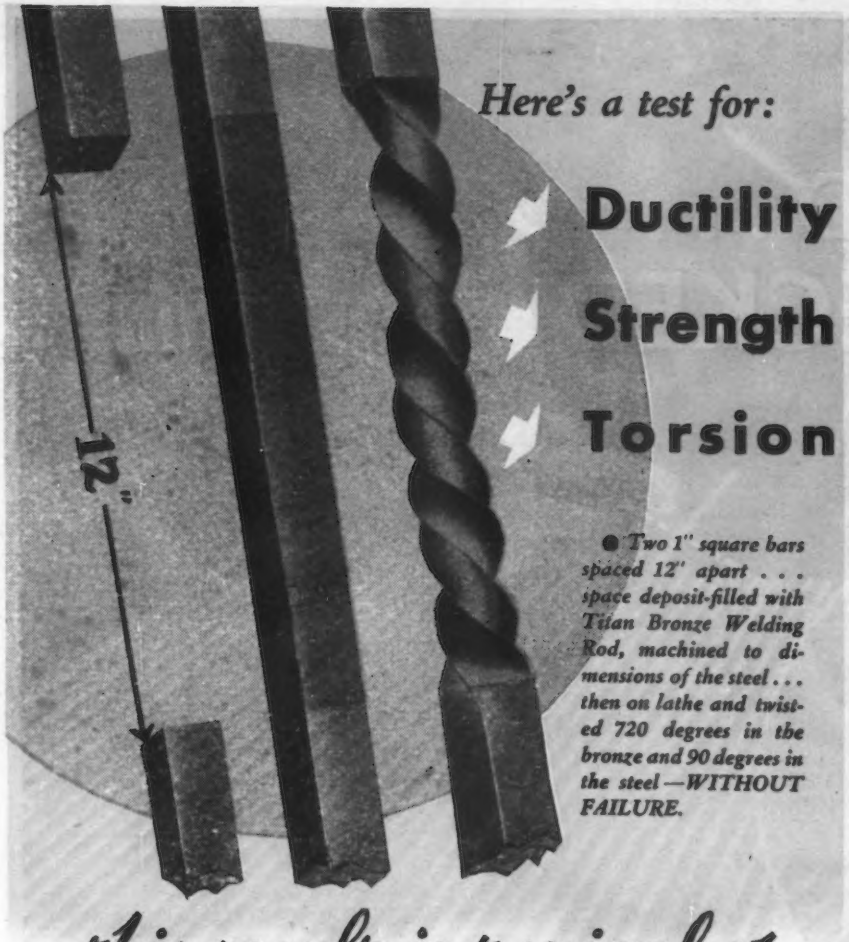

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Harvester Promises High Employment Level to Continue

Milwaukee

• • • **The local works of the International Harvester Co. is expected to maintain its present employment level and continue to be one of the largest and most important of the firm's manufacturing centers, according to H. T. Reishus, Chicago, general manager of International's industrial power division.**

Converting the plant from war to peace products, while difficult, should not be long drawn out, Reishus said, adding that only nominal readjustments in employment is involved.

The plant's principal military production job during the closing months of the war was the manufacture of diesel motors. Most of these diesels went into crawler tractors or were used to power generators, used by the army and navy for the generation of electric power all over the world. This production will now be converted to civilian use.

A large market awaits the civilian diesels, Reishus said. There were many prewar applications of diesel power, including crawler tractors, in mines, oil fields, logging operations, irrigation, generation of electric power and many others.

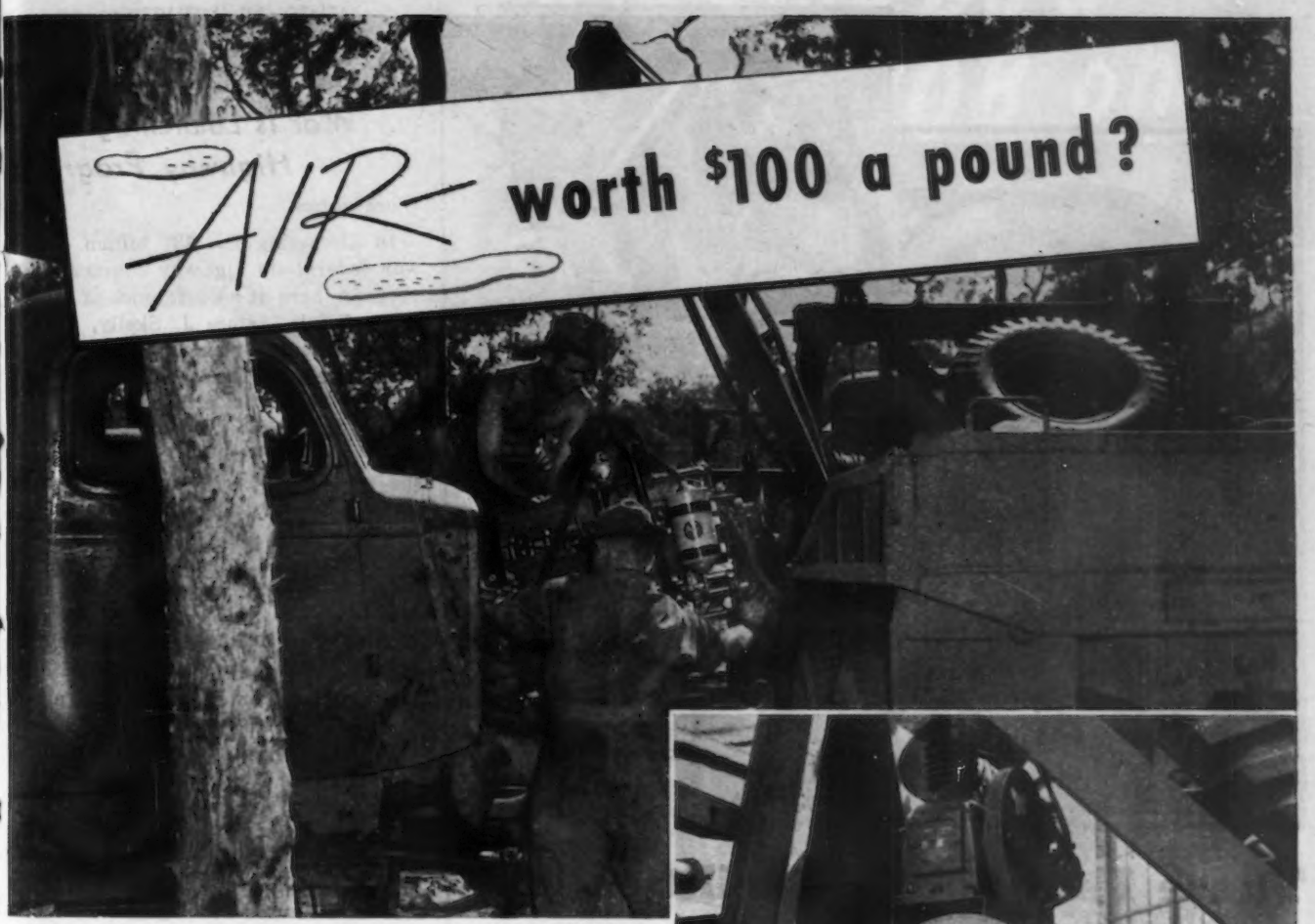
In addition, there has been a big expansion in the application of diesel power to new uses during the war. This is expected to be an important factor in the postwar market, Reishus said. The company's industrial power division has large backlogs of orders from civilian users in both of these categories.

The reconversion job at Milwaukee works has been accomplished already, in part, through Harvester's enlarged farm implement and farm tractor manufacturing program, which got under way about a year ago. The Milwaukee works makes many component parts of such farm equipment, including gears, castings, forgings, etc.

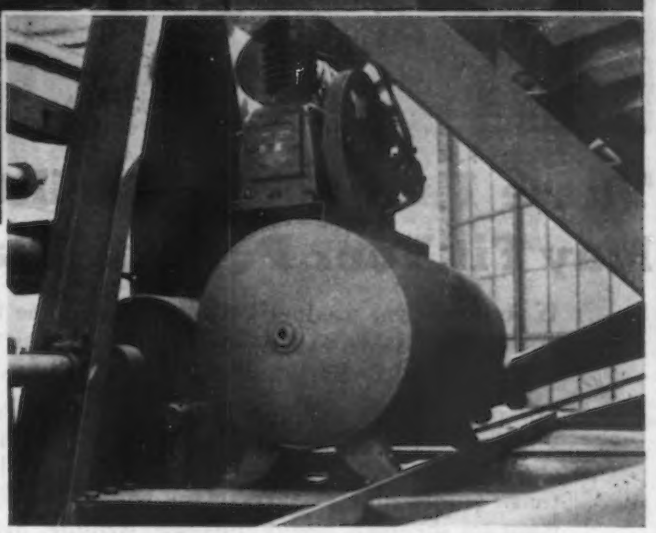
The works also assembles the larger four wheel type farm tractors which Harvester builds.

Undoubtedly, when postwar plans are developed the Milwaukee works will have at least as many, and probably more employes than it had in the best of the prewar years, Reishus said.

AIR worth $100 a pound?



Signal Corps Photo



AIR IS FREE—in the jungle as in your own backyard. But *compressed* air, which they could put to work in an emergency, was often worth $100 a pound and more to our victorious fighting men. In the case of a truck carrying vital supplies delayed by want of air for tires, it might have represented a *priceless* commodity.

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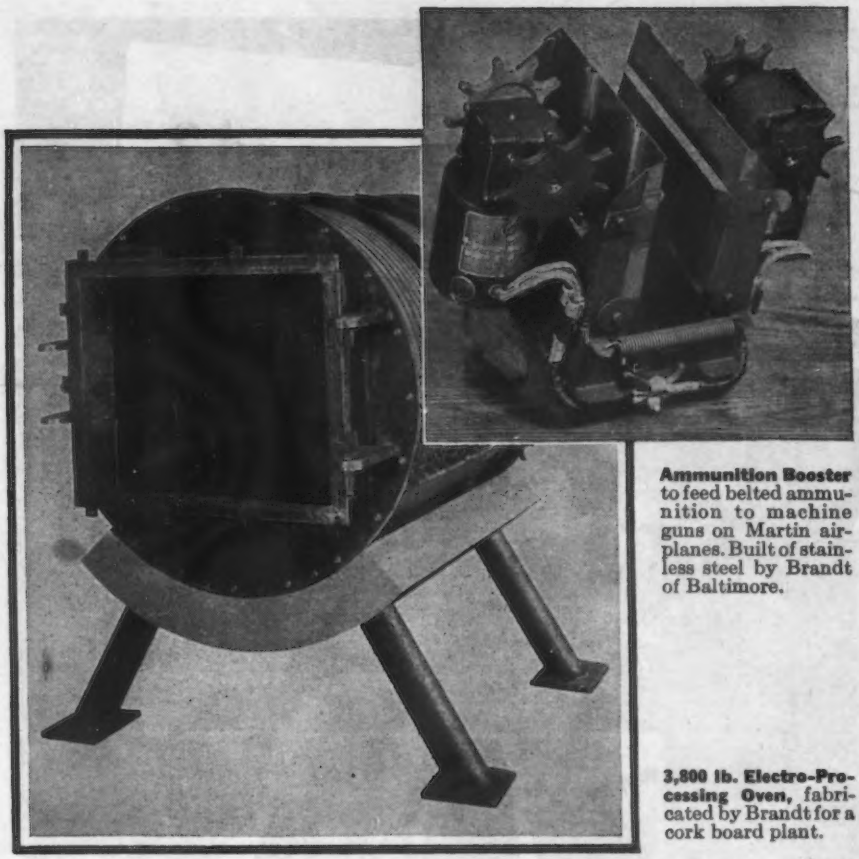

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Official End Of War Is Launching Highway Program

Washington

In discussing the $37 billion postwar federal-aid highway construction program here at a conference of highway officials, James J. Skelly, president of the American Road Builders' Assn. cited the Federal-Aid Highway Act of 1944. It provides that the funds authorized for road building under this act shall be available when the war emergency is declared over by Presidential proclamation, by a concurrent resolution by Congress to that effect, or by a concurrent Congressional resolution declaring that the emergency has been relieved to an extent that will justify proceeding with highway construction.

Mr. Skelly pointed out the act provided that $100 million might have been appropriated for surveys and plans and for construction. But inasmuch as Congress did not appropriate this sum, the only federal funds that can be used now without waiting for formal action are $105 million left over and unused from previous federal aid allotments. When matched by the states, it would double this amount.

"Hostilities with Germany and Japan have ceased, but the $500 million of federal aid authorized by the act cannot be used for contracts made before the first postwar fiscal year which does not begin until the President or Congress takes action. In all probability, it will be the second of the concurrent resolutions that will officially launch our building program when Congress reconvenes in September," said Mr. Skelly.

"Practically all these states have accumulated sizeable funds for road building and these may be used at once for badly needed local projects or matched against the federal funds already available," the road builders' president continued. "It is possible for states to advertise for bids to be let coincident with the official end of the emergency."

Work on the 40,000-mile interregional highway system which is to link centers of 100,000 population and upward will not commence for some months, Mr. Skelly believes. While practically all the states have filed their recommended routes with the Public Roads Administration, meetings with various state highway departments must be held before the

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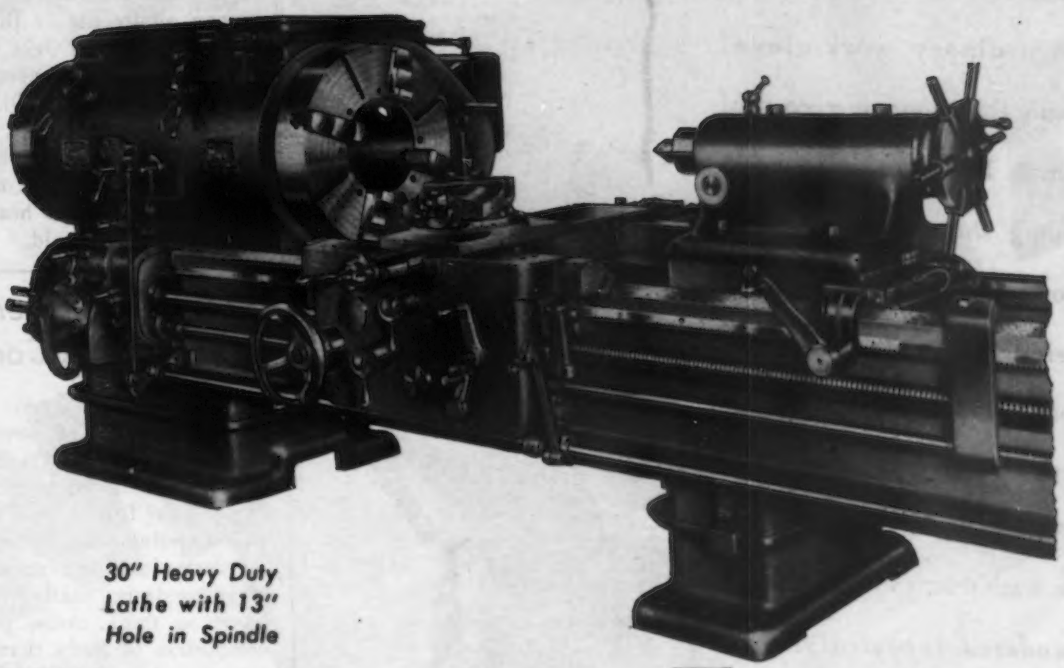

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system is finally coordinated. The integrated system will be approved in its entirety, according to the PRA and covers the major features of the highways involved. Initiative for the actual highways rests with the various state highway departments.

The American Road Builders' Association president called attention to the fact that the interregional system was eligible for federal aid under both the federal-aid highway and urban allotments of the act of 1944. Undoubtedly the first work done on it will be in connection with the cities, he declared. During the first year much of the work on federal-aid highways will be reconditioning and modernizing stretches that have suffered severely from heavy war emergency traffic, he said.

Postwar Improvements In Tools Coming Soon

New York

• • • Release of several radically new developments in machine tool design is believed to be forthcoming in the near future. Shortages of critical materials, the press of wartime deliveries and the necessity for restricting design staffs to current work have, in most cases, prevented the completion of more than preliminary experiments. But now that the pressure has been eased somewhat, it is expected that development will go along in fast order and that some startling announcements will be made.

With Washington's decision as to the disposition of war-surplus machine tools still to be declared, and with no announcement as yet made concerning even the broad policy to be followed in this matter, the position of the machine tool industry is naturally very unsettled; but it is believed that these new advances in design may be sufficiently interesting to influence buyers to wait for delivery of new equipment, rather than to accept older style machines even if offered at a substantial reduction in price.

Thus far, only the vaguest hints are available as to the character of these new developments but it is reasonable to believe that they have to do with simplification of set-up, higher speed ranges, improved automatic operation, longer machine life, greater accuracy and higher productivity. These are all features which must appeal to the postwar buyer, and which must be looked for if industry is to be able to produce vast quantities of goods essential to national prosperity.

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Similarly, a way was found to reduce the thickness of the asbestos tape while actually increasing its tensile strength.

Result: A more solid magnet with about 25% greater coil strength . . . a cooler coil that uses less current . . . a lighter, longer lasting magnet. For complete details write to Dings—today.

DINGS FEATURES:
- Coil locked in place to prevent damage and short circuiting.
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Steel Engineers Assn. Will Hold District Meets in Key Cities

Pittsburgh

• • • **Because the railroad situation** is still tight and the ban is on sleeping accommodations the Association of Iron & Steel Engineers this year will establish its fall program by having sectional meetings at close intervals. A complete program for each city follows:

BIRMINGHAM
Sept. 17, 1945
Thomas Jefferson Hotel

9:00 A.M. Registration

9:30 A.M. Technical Meeting

"Modern Conveying Systems in Steel Plants," by L. L. Horchitz and Paul W. VanOrden, B. F. Goodrich Co., Akron, Ohio.

"The Manufacture of Byproduct Sulphuric Acid from Hydrogen Sulphide in Coke Oven Gas," by W. A. Leech, Jr., Koppers Co., Inc., and F. D. Schreiber, Pittsburgh Coke & Chemical Co., Pittsburgh.

1:30 P.M. Technical Meeting

"Rapid Heating of Steels with Gas Fuel to Heat Treating or Forging Temperatures," by Frederic O. Hess, president, Selas Corp. of America, Philadelphia.

"Carbon Products in the Steel Plant," by Frank Vosburgh, National Carbon Co., Inc., New York.

"Blast Furnace Skip Hoists," by Gordon Fox, vice-president, Freyn Engineering Co., Chicago.

7:00 P.M. Dinner

Reservations for dinner must be made in advance to: A. L. Lemon, secretary, Birmingham District Section, Association of Iron & Steel Engineers, 1722 First Ave., N, Birmingham, Ala.

DETROIT
Sept. 24, 1945
Fort Shelby Hotel

9:30 A.M. Registration

10:00 A.M. Technical Meeting

"Humidity Measurements and Control in Steel and Allied Industries," by O. J. Leone, regional manager, Steel Mill Div., The Bristol Co., Pittsburgh.

"Blast Furnace Skip Hoists," by Gordon Fox, vice-president, Freyn Engineering Co., Chicago.

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1:30 P.M. Technical Meeting

"A Modern Electric Furnace Installation," by Frank W. Brooke, vice-president, Swindell-Dressler Corp., Pittsburgh.

"Applying Fluid Drive in Industry," by G. V. Edmondson, staff engineer, Hydraulic Coupling Div. of American Blower Corp., Detroit.

"Modern Conveying Systems in Steel Plants," by L. L. Horchitz and Paul W. VanOrden, B. F. Goodrich Co., Akron, Ohio.

6:30 P.M. Dinner

Reservations for dinner must be made in advance to: Elmer F. Weiss, secretary, Detroit District Section, Association of Iron & Steel Engineers, 2759 E Grand Blvd., Detroit.

PITTSBURGH
Sept. 26, 1945
Hotel William Penn

9:30 A.M. Registration

10:00 A.M. Technical Meeting

"Causes and Cures of Transient Voltages on Distribution Systems," by G. D. McCann, transmission engineer, Westinghouse Electric Corp., East Pittsburgh, Pa.

"Friction Sawing, Past and Present," by James M. Lewis, consulting engineer, Kling Bros. Engineering Works, Chicago.

2:00 P.M. Technical Meeting

"Recent Development in the Pyrometry of Liquid Iron and Steel," by H. T. Clark, assistant manager of research and development, Jones & Laughlin Steel Corp., Pittsburgh.

"The Spraying of Gear Lubricants," by D. E. Whitehead, chief lubrication engineer, Carnegie-Illinois Steel Corp., Pittsburgh.

"Carbon Products in the Steel Plant," by Frank Vosburgh, National Carbon Co., Inc., New York.

6:00 P.M. Dinner

Reservations for dinner must be made in advance to: Brent Wiley, managing director, Association of Iron & Steel Engineers, 1010 Empire Bldg., Pittsburgh 22, Pa.

CHICAGO
Oct. 1, 1945
Del Prado Hotel

9:30 A.M. Registration

10:00 A.M. Technical Meeting

"Electric Drives for the Unitemper Mill—Their Selection and Operation," by J. D. Campbell, Steel Mill

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The automatic block signals that make railroad travel safe today, and have contributed so much to the working of transportation miracles, started long ago . . . in 1867. And in that same year, Freedom Forge—even then 72 years old—installed another new development to serve the railroads.

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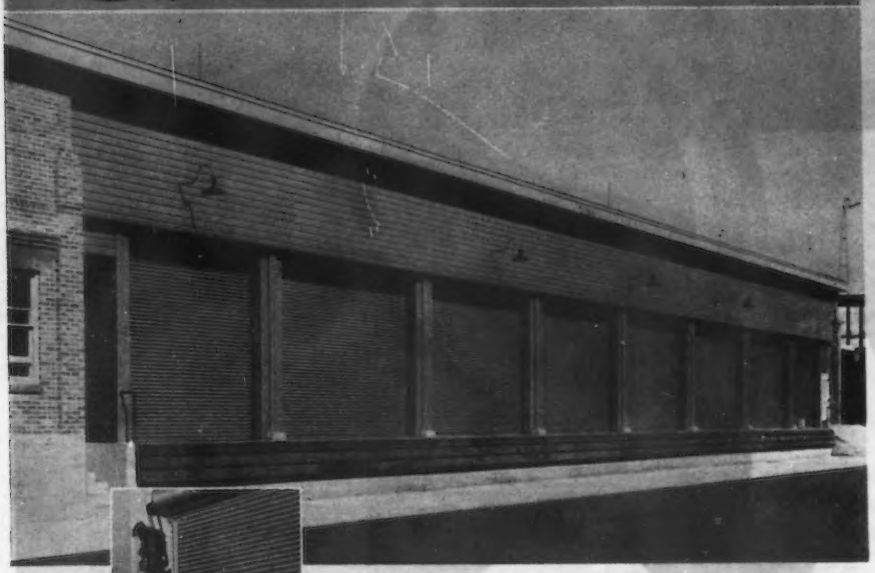

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Div., Industrial Engineering Div., General Electric Co., Schenectady, N. Y., and J. G. McCurley, electrical engineer, Republic Steel Corp., Warren, Ohio.

"Rail Mills and Rail Mill Roll Design," by Ross E. Beynon, superintendent of Roll Shop Div., Carnegie-Illinois Steel Corp., South Chicago, Ill.

2:00 P.M. Technical Meeting

"Reclamation of Oils," by Jos. D. Lykins, lubrication engineer, Wheeling Steel Corp., Yorkville, Ohio.

"Some Characteristics of Blast Furnace Gas," by Owen R. Rice, metallurgical engineer, Freyn Engineering Co., Chicago.

"Development and Application of Twin Motor Drives," by G. E. Stoltz, manager, Steel Mill Engineering Dept., Westinghouse Electric Corp., East Pittsburgh, Pa.

6:00 P.M. Dinner

Reservations for dinner must be made in advance to: A. J. Whitcomb, secretary, Chicago District Section, Association of Iron & Steel Engineers, 58 E Washington St., Chicago.

CLEVELAND
Oct. 3, 1945

Hollenden Hotel

9:30 A.M. Registration

10:00 A.M. Technical Meeting

"Seamless Tube Piercing and the Problem of Making Steel Satisfactory for the Process," by Newell Hamilton, superintendent — steel plant, The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

"The Manufacture of Byproduct Sulphuric Acid from Hydrogen Sulphide in Coke Oven Gas," by W. A. Leech, Jr., Koppers Co., Inc., and F. D. Schreiber, Pittsburgh Coke & Chemical Co., Pittsburgh.

2:00 P.M. Technical Meeting

"Conservation of Utilities in Republic's Canton Plant," by P. L. Walter, superintendent, Mechanical Dept., Republic Steel Corp., Canton, Ohio.

"Arc Furnace Switching," by L. W. Long, engineer, Allis-Chalmers Mfg. Co., Milwaukee, and J. C. Chipman, engineer, Allis-Chalmers Mfg. Co., Boston.

"An Examination of Slow Cooling Methods," by J. William Barker, staff consultant, and Earl R. Cole, engineer, Industrial Furnace Div.,

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7:00 P.M. Dinner

Reservations for dinner must be made in advance to: W. W. Spanagel, secretary, Cleveland District Section, Association of Iron & Steel Engineers, 16129 Euclid Ave., Cleveland, Ohio.

PHILADELPHIA
Oct. 6, 1945

Engineers' Society

9:30 A.M. Registration

10:00 A.M. Technical Meeting

"Thermit Welding in Steel Plant Maintenance," by J. H. Deppeler, chief engineer, Metal & Thermit Corp., New York.

"Rapid Heating of Steels with Gas Fuel to Heat Treating or Forging Temperatures," by Frederic O. Hess, president, Selas Corp. of America, Philadelphia.

2:00 P.M. Technical Meeting

"The Sendzimir Precision Cold Strip Mill," by T. Sendzimir, vice-president, Armzen Co., Middletown, Ohio.

"Lighting Improvements and Developments for Steel Plants," by Davis H. Tuck, professional engineer—electrical, Holophane Co., Inc., New York.

"The Spraying of Gear Lubricants," by D. E. Whitehead, chief lubrication engineer, Carnegie-Illinois Steel Corp., Pittsburgh.

6:00 P.M. Dinner

Reservations for dinner must be made in advance to: Linn O. Morrow, secretary, Philadelphia District Section, Association of Iron & Steel Engineers, Schaff Bldg., Philadelphia, Pa.

Graphite Bronze Pays 50c

Cleveland

• • • Directors of Cleveland Graphite Bronze Co. recently declared a dividend of 50 cents a share on common stock and the regular quarterly divident of $1.25 a share on 5 pct preferred stock, both dividends being payable September 12 to stockholders of record September 1.

The common dividend will be the 93rd to be paid in consecutive quarters beginning with the third quarter of 1922. The 50 cent rate has been uniform for the last eleven quarterly periods.

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TRADE MARK

ASME Group Sees Atomic Power For Gas Turbine Drive

New York

• • • **Atomic power, as a servant of mankind rather than as an agent of destruction, may find one of its first applications as a new source of energy to drive gas turbines, in the opinion of many members of the Gas Turbine Coordinating Committee of the American Society of Mechanical Engineers, which has begun preliminary study of the place which may be filled by the discovery in the field of power sources.**

"Atomic power is an addition to the world's supply of fuel," stated R. Tom Sawyer, Chairman of this ASME Committee. Mr. Sawyer, of the American Locomotive Co., a recognized authority on diesels and gas turbines, and author of the recently published book, "The Modern Gas Turbine," said: "It is felt that atomic power certainly will not replace present fuels but will supplement them, as oil supplements coal."

Members of the committee, a part of the Oil and Gas Power Division of the ASME, were asked by their chairman to respond to an initial questionnaire on the subject of atomic power.

"If we could take a small portion of plutonium and release its power bit by bit into a jet propulsion unit, we would, no doubt, have a plane which would fly from here to China without refueling," said one questionnaire.

While many of the committee members who replied shared the belief of the chairman in the future use of atomic energy for gas turbines, some viewed the field as too highly speculative, or believed security regulations too strict, to warrant exploration by the committee at the present time.

Two major obstacles stand in the way of the application of atomic energy in the field of industrial power: the cost of producing this energy will be high at first, and the technical problems involved in using atomic power to obtain mechanical energy through such agencies as the gas turbine will require extensive research.

In the light of recent gas turbine development, engineers visualized a broad pattern of power generation for the near future in which the diesel would find widest use in sizes below about 2000 kw, and the gas turbine in sizes from about 2000 kw to possibly 20,000 kw. The steam turbine

THE KIND OF CASTINGS *that Steam Turbines Require*

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would dominate the large-power field, in unit sizes up to and above 100,000 kw.

"It now seems possible that atomic power may create a unit above 200,000 kw wherein both the gas and steam turbine are utilized in the same plant, using both present fuel and atomic power to achieve the greatest efficiency," Mr. Sawyer believes.

While committee members feel themselves now "at a new doorway in science opened by the bomb," they note the immediate implication that atomic power's tremendous release of heat offers possibilities for controlled use of such heat in driving a gas turbine.

"In normal gas turbine work temperatures of about 3000°F must be reduced to the range of 1000 to 1500°F by the introduction of a large surplus of air," an engineer states.

"With atomic power, temperature far in excess of 4,000° would make necessary the introduction of much larger quantities of air for cooling to a point which the turbine blades can stand. Resistance of turbine blade materials to heat has been improved steadily but, apparently, much additional work in that direction is indicated to make atomic power available for gas turbines.

"Possibility exists also that radioactive by-products of the atom-splitting process might make the air unusable in a gas turbine. It appears from this consideration that a semi-closed cycle might be preferred, using the heat created but eliminating the radio-active by-products from the gas turbine."

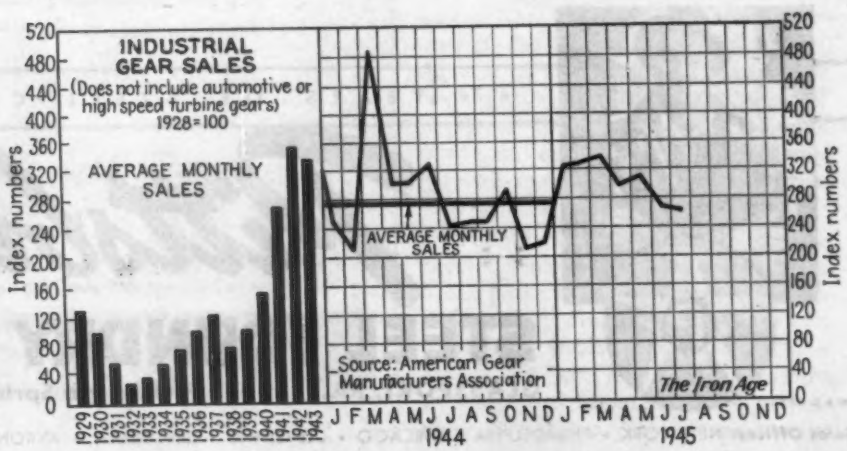
It is also pointed out that heat is dispersed in the process of creating atomic energy, as well as by such energy itself. Such heat, originating in the process might be used in driving, a turbine, the engineers feel.

Advantages in atomic power which might outweigh costs for some applications include probable lighter fuel load, a major factor in aviation but of less importance with reference to costs in railroad locomotives, ships and stationary power, the engineers state.

The Gas Turbine Coordinating Committee of the American Society of Mechanical Engineers is composed of many of this country's leading authorities on gas turbines, and is a representative group drawn from the industrial, educational and publishing fields. Members are: R. Tom Sawyer, chairman, American Locomotive Co.; J. H. Anderson, Ingersoll Rand Co.; Kenneth A. Browne, Chesapeake & Ohio Railway Co.; J. M. Campbell, General Motors Corp.; J. R. Carlson, Westinghouse Electric Corp.; R. F. Gagg, Wright Aeronautical Corp.; Dean J. A. Goff, University of Pennsylvania; Professor C. W. Good, University of Michigan; R. Herold, Sulzer Brothers; J. S. Haverstick, De Laval Steam Turbine Co.; C. H. Johnson, Federal Ship Building & Dry Dock Co.; Professor C. F. Kayan, Columbia University; Professor J. H. Keenan, Massachusetts Institute of Technology; J. N. Landis, Consolidated Edison Co. of N. Y.; Captain Paul F. Lee, U. S. Navy; Professor John M. Lessells, Massachusetts Institute of Technology; J. B. Macauley, Jr., Pratt & Whitney Aircraft; Martin A. Mayers, Elliott Co.; Alan Osbourne, U. S. Maritime Commission; A. E. Pew, Jr., Sun Oil Co.; Dr. J. T. Ret-

JULY GEAR SALES DECREASE

. . . The gearing industry, as represented by the members of the American Manufacturers Assn., shows a decrease in volume of sales for July, as compared with June, of 2.6 pct. This report does not include turbine or propulsion gearing. The index figure for July was 264.



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VICTOR
1. SPEED—The correct setting of the teeth in Victor Hack Saw Blades assures fast cutting and full side clearance.
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3. QUALITY—The fine grade of high-speed steel, scientifically heat-treated, makes the Victor Blade a superior tool.
4. SERVICE—Like old friends they wear well—and long, because they are BETTER blades in every way.
Guide to Better Sawing
Send for a copy of this pocket-size booklet on how to select, use, and care for a hack saw blade.
METAL CUTTING
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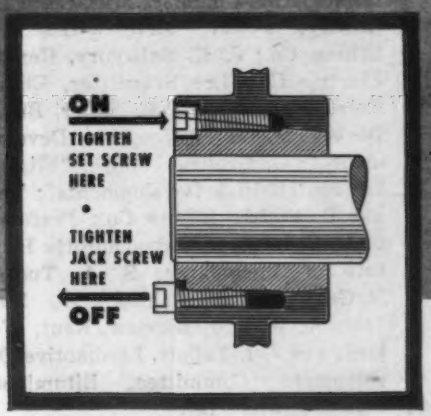
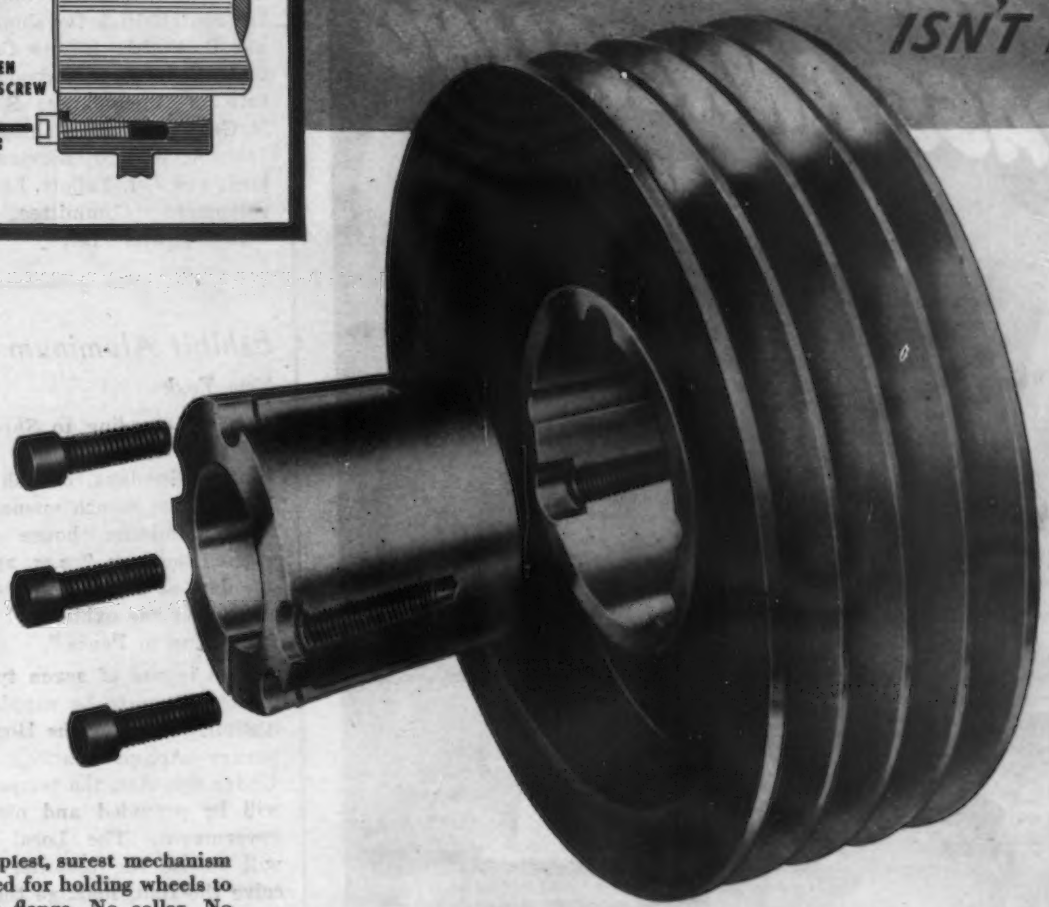
VICTOR SAW WORKS, Inc.
Middletown, N. Y.
Makers of hand and power hack saw blades, frames, and metal cutting band saw blades.

Simple, ISN'T IT?





The simplest, surest mechanism ever devised for holding wheels to shafts! No flange. No collar. No protruding parts.

- The Taperlock Sheave mounts as a complete unit. Slip it on, line it up and tighten *while sighting.* It's in place on the first try!
- The bushing is wedged into the sheave by means of set screws—with a firmness equivalent to a shrunk-on fit—whether the shaft is standard or normally undersize.
- The Taperlock runs *true.* The bushing extends the entire length of the hub; it provides a *full* bearing surface.
- Close mountings are made possible. No flange nor collar nor other device is required at either end of the sheave hub.
- The Taperlock "unlocks" with less effort than any other sheave—due to its special taper.
- Taperlock Sheaves will be stocked by Dodge Transmissioneers in principal cities—and will be available in ALL stock sizes.

New TAPER-LOCK *Sheave*

PATENT APPLIED FOR

Easy on—easy off—locks fast to the shaft! ALL the advantages you've ever dreamed about in a sheave are *here*—in the simplest, quickest acting mechanism ever developed for the purpose!

For full details call your local Dodge Transmissioneer. You'll find his name listed under "Power Transmission Equipment" in your classified telephone directory. Or write

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

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SIGN OF THE DODGE TRANSMISSIONEER
There are 257 Dodge factory graduate Transmissioneers, located in principal cities, to show you NEW and BETTER ways of transmitting power. See your local classified telephone directory.

R-S gas-fired Furnace, twin-chamber pan type, capacity 27,000 lbs. per hour. Maximum temperature: 1500°F. Each chamber 5 feet wide and 36 feet long.

Plan now to operate R-S Continuous Furnaces for post-war production.

R-S Furnaces of Distinction

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Exhibit Aluminum House

New York

• • • According to *Sheet Metal Industries*, British trade paper, Mr. Duncan Sandays, British Minister of Works, last month opened an exhibition aluminum house which was erected between 9 a.m. and 5 p.m. of one day, at Selfridges, Oxford Street, as part of the exhibition. "Aluminum from War to Peace."

This is one of seven types of temporary house to be supplied to Local Authorities under the Housing (Temporary Accommodation) Act, 1944. Under this Act, the temporary houses will be provided and owned by the government. The Local Authorities will choose the tenants, fix and receive the rent, manage the house and keep them in repair.

An order for 50,000 aluminum houses has been placed by the Minister of Works, the Ministry of Aircraft Production acting as agents for production. This order is being treated on lines similar to the manufacture of aircraft.

Production will take place at five centres: Bristol Aeroplane Co., Ltd., at Weston-super-Mare; Hawksleys, Ltd., at Hucclecote; Vickers Armstrongs, Ltd., at Chester and Blackpool; and Blackburn Aircraft, Ltd., at Dumbarton. The Bristol Areoplane Co., Ltd., act as the parent firm of the group, and High Duty Alloys, Ltd., are technical advisers to them.

The exhibition house was produced at the Bristol Aeroplane Co., with Hiduminium Applications as design consultants. Production will begin on a small scale this month at the parent factory, and will be followed shortly at the other works; this will eventually build up to a peak production of 5,000 houses a month.

WHEN MILLING HAS TO BE DONE WITH SPEED, PRECISION, PROFIT

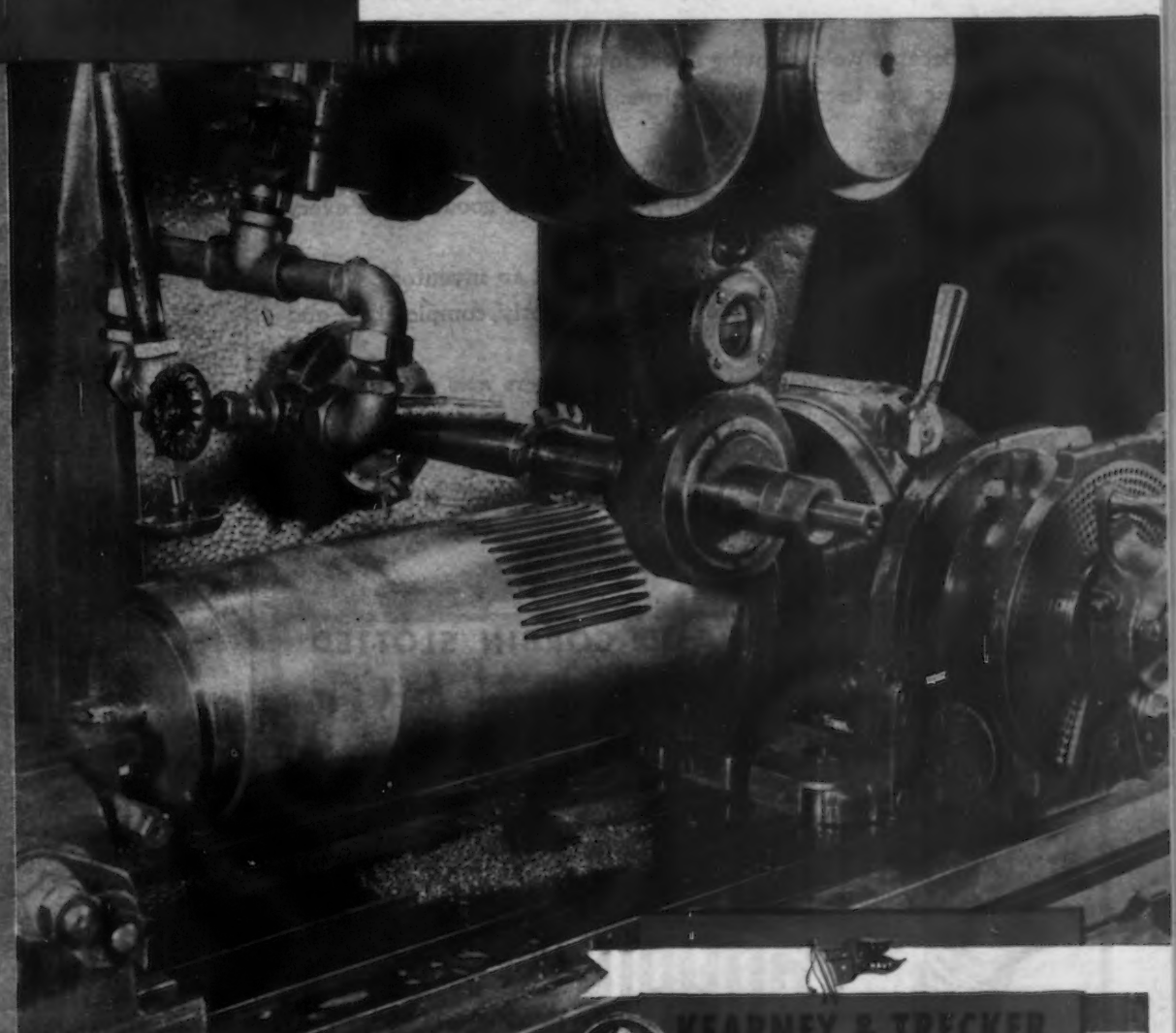
PUT IT ON A *Milwaukee*

A 3K Milling Machine equipped with Model K Dividing Head and Tailstock — Gashing Slab Milling Cutter.

In tool-room or laboratory — on the production line — wherever milling has to be done — simple routine job or "tricky" operation — put it on a Milwaukee! Experienced machine-shop men prefer to use a Milwaukee when it is available because they know that's the way to get the work done — with speed, precision, profit.

Time-tested, production-proved, modern in every detail of design and construction but free of untried features, Milwaukee Milling Machines yield the sustained performance — with precision and speed — that spell profit in milling operations.

Write for new Bulletin K10 giving detailed and descriptive information on Model 2K and 3K Milwaukee Milling Machines.



Milling a worm gear in a spindle quill on a 3K Universal Milling Machine. Angular 7° spacing of cut is indexed with less than one turn of the index handle on the Model K Dividing Head.

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MILWAUKEE — WISCONSIN

Milwaukee Machine Tools

TO HELP YOU
BUILD UP YOUR INVENTORY OF SCREWS AND NUTS

92% IMMEDIATE DELIVERY ... *here's our Ante*

It's going to be a fast game from now on, *and we're staying!* So are you . . . *if you start now to build an inventory large enough to supply momentum.*

For unless you can *roll along*, you may be stalled in the months to come!

Why? Because we're fighting a war in which *transportation* by rail, truck and air can become the bottleneck unless Uncle Sam has the right of way.

Why? Because we're reconverting from war production, where speed was the essence, to mass manufacture of peacetime goods where every penny counts.

Wholesale Distributors who start *now* to build an inventory will be in the best position to handle their orders promptly, completely — and economically.

Retail Merchants who order from their jobbers *now* will do more selling and less explaining in the months to come.

Corbin is still producing for war . . . but our facilities today enable us to offer 92% IMMEDIATE DELIVERY for those important inventories needed now to prevent congestion later. Don't wait — or you may be kept waiting!

CORBIN-PHILLIPS AND CORBIN SLOTTED

Wood Screws, Machine Screws, Hardened Sheet Metal Screws, Self-Tapping Machine Screws, Stove Bolts. Aircraft Screws to government specifications . . .
Also — Steel Drive Screws, Lag Screws, Cap Screws, Set Screws, Hex Semi-Finished Nuts, Machine Screw Nuts, Escutcheon Pins and Chain.

THE CORBIN SCREW CORPORATION
The American Hardware Corp., Successor
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CORBIN
Screws Nuts Chain

Employment Prospects Bright; Reconversion Fast in Milwaukee

Milwaukee

• • • According to a survey made by the Milwaukee *Journal*, mass terminations of contracts will not result, immediately at least, in slashing of employment by factories in this region.

Some plants are actually prepared to increase their working forces, while others indicate that lay-offs will be moderate, with most workers being rehired after facilities are converted to peacetime production.

This is partly a result of postwar planning by business the last two years with the Milwaukee Assn. of Commerce postwar planning committee.

Another factor is the diversified nature of industry here. Many firms will be called on to meet the long pent up demand for consumer goods. Others manufacture mechanical equipment needed in rehabilitation work throughout the world, while additional concerns turn out equipment which plants need before they can make consumer goods.

Companies here were almost unanimous in saying that although some materials are bound to be scarce for months, they will be able to keep in production by building equipment in part, with final assembly postponed until missing materials become available.

Reports by Firms

Kearney-Trecker Corp. — Joseph Trecker, vice-president, said that while some change in contracts is to be expected when the war ends, the company has a sufficient backlog of orders for machine tools to keep its employment around its present 2700 level.

Le Roi Co.—Charles Pendock, president: Fifty pct of production is already in the civilian field and a considerable volume of business is on the books both from domestic firms and foreign ones. The firm, which produces compressors, engines, etc., now has 1200 on the payroll and can use additional help.

Bucyrus-Erie Co.—W. W. Coleman, chairman of the board: The firm can still use an additional 300 men if it can get them. A substantial backlog was reported for the firm's excavating equipment.

Cutler-Hammer, Inc.—Official state-

Do you know that . . .

LAST YEAR MORE AIRLINE PASSENGERS IN THE UNITED STATES FLEW ON SINCLAIR PENNSYLVANIA MOTOR OIL THAN ON ANY OTHER OIL . . . SINCLAIR AVIATION GASOLINE WILL AID FLYING ON NATIONAL AND INTERNATIONAL ROUTES.

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FOR BETTER LUBRICATION OF MACHINING EQUIPMENT, SINCLAIR PRODUCES A WIDE RANGE OF SPECIALIZED HYDRAULIC, SPINDLE, GEAR AND GENERAL PURPOSE OILS . . . ALSO A DIVERSIFIED LINE OF CUTTING OILS ADAPTED TO EVERY MACHINING PROBLEM.

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Judge a coolant pump by the company it keeps

You can best judge a coolant pump by finding out who uses it.

Ruthman Gusher Coolant Pumps are installed as standard equipment by many of the leading manufacturers of machine tools all over the world. Experience has taught them that Ruthman Coolant Pumps give dependable long service with minimum maintenance cost.

These satisfied customers are your best guarantee of the service which Ruthman Gusher Coolant Pumps will give you. Specify Ruthman Pumps for all your coolant needs.

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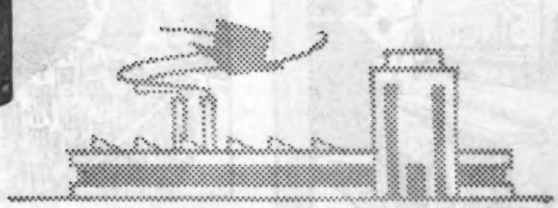

THE RUTHMAN MACHINERY CO.

1821 READING ROAD CINCINNATI 2, OHIO

THE "GUSHER"

A MODERN PUMP FOR MODERN MACHINE TOOLS

ment: The company has a considerable backlog of commercial orders and many of its customers' reconversion plans are going along rapidly. While Cutler-Hammer has received many cancellations of war contracts, it does not think there will be any falling off of employment. The company, as a matter of fact, is short approximately 400 workers.

Allis-Chalmers Co. — A company spokesman said that for some time the firm has directed its plans toward softening the impact of reconversion. "Our tractor production already is on the increase and a further increase is expected. For some time we have also been able to accept orders for certain classes of machinery without a priority. Some large turbo-generators already are under construction and additional orders are expected," it was said.

A. O. Smith Corp.—A spokesman said: "The first result of the cessation of hostilities with Japan will be a sigh of relief from the management which for four years has been unable to find facilities, materials or manpower to make the products that kept the Smith plants busy for 70 years before the war. In spite of the fact that peacetime selling has been severely restricted, back orders for peacetime products will keep some divisions of the company working full time for from several months to a year. In some divisions production facilities will have to be materially expanded. In others, newly designed postwar products are ready for production just as fast as plant space can be cleared of war manufacturing equipment and new equipment, tools and fixtures procured."

Ampco Metal, Inc. — J. D. Zaiser, vice-president: The firm does not build complete products but supplies castings for other producers' equipment. Consequently it will have to wait on orders before it can accurately estimate what the employment picture will be. However, the firm has four or five postwar projects that "should grab hold" within 90 or 120 days after the end of the war. As a result it was hoped that tapering off war work for the navy and air corps would be offset by civilian work to a large extent, with ultimate employment holding close to the present level of 1200. The peak wartime employment of the firm was 2700.

Falk Corp.—Harold Falk, president, does not look for any material change in the firm's employment or production for the balance of the

BACK TO "civies"!

And, as far as G.I. Joe is concerned . . . *but fast!*

And it's back to "civies" for all industry, too, as the nation gets ready for the peacetime change.

We at Levinson Steel, proud of our reputation for dependability and service, have already "changed clothes." We've rolled up our sleeves and are ready to go to work. We're prepared *now* to handle your inquiries for warehouse and fabricated steel.

'Phone, wire, write!

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Warehousers—Fabricators

PITTSBURGH, PA.

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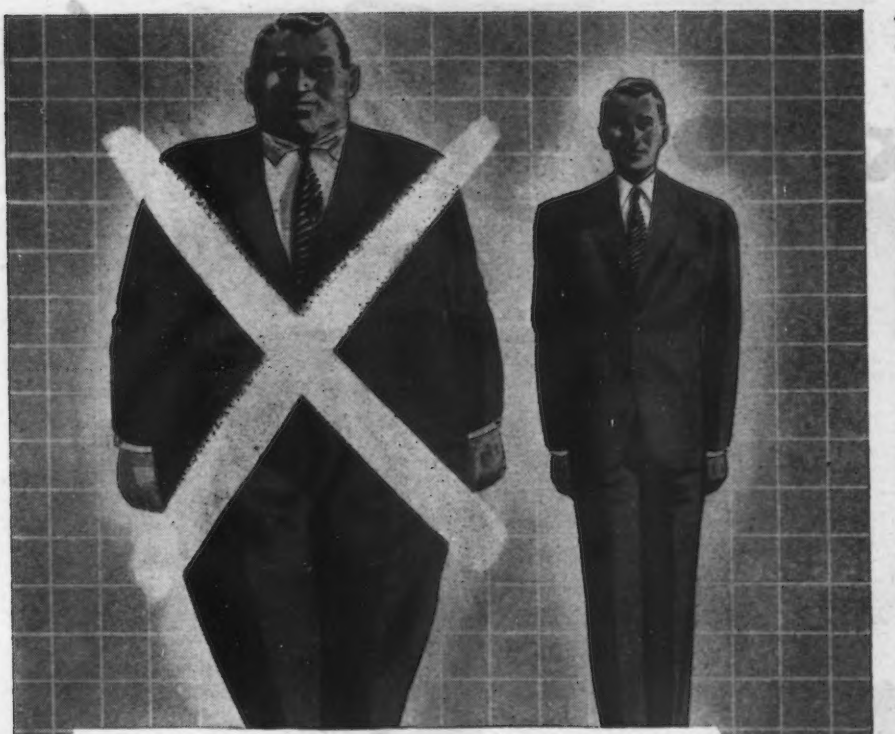

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Not "human weight and bulk"—but, the kind of weight and bulk that manufacturers are up against when it comes to taking full advantage of a minimum freight car.

For example, a certain company was only getting about two-thirds of the box car load they were buying because of the way their product was wrapped and packaged.

Fibreen licked that one. With it, so compact a package was provided that where only *40* units were loaded into a car before, *60* were moved in . . . and still it went forward as a minimum car. Figure the saving, yourself.

In addition, considerable labor was saved and added protection to the contents was realized.

Maybe your wrapping and packaging problem lends itself to Fibreen. Get the facts on what this tough, dirt and waterproof paper has done for others and perhaps might do for you. Why not write for samples and complete information?

Sisal fibre reenforcement for strength—special asphalt for water-proofness—kraft paper for clean, easy handling—sealed by heat and pressure to produce Fibreen.

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year. Falk indicated he thought 1946 business of the firm would be equal to about 40 pct of 1945's, but that employment would not be cut by a corresponding amount. The reason is that the firm is improving its lines of civilian products and studying new lines. A total of 2600 are now at work compared to a peak of 3400.

Unit Crane & Shovel—"We're making our peacetime models for the services now. About all we'll have to do is use a different color of paint." The company has a substantial backlog of civilian orders to which it is turning immediately.

Davis & Thompson Co., producers of special machines for high speed production.—No reconversion problem; will swing immediately into work on a large backlog of civilian orders for special machinery.

Globe Steel Tubes Co.—No reconversion problem, because the company is making the same type of product, tubing, for the services that it did pre-war.

Vilter Manufacturing Co.—E. B. Tilton, president: Production of 105 millimeter howitzers already has ended. Company is already in full scale production of heavy refrigeration and air conditioning equipment for industrial and commercial users. Present employment of 650 will be continued and it is hoped to increase that figure for work on a heavy backlog of orders when materials can be obtained.

Delta Manufacturing Co., producer of machine tools.—An official said the firm expects very little of a reconversion problem. It will continue production postwar on a scale permitted by availability of materials. It hopes to increase its present employment figure.

Heil Co.—Joseph Heil, Jr., vice-president: The company already has partially reconverted. It will be unable to reconvert entirely until contracts are terminated and machinery is moved out. Estimates a three-month period after termination for the full swing to peacetime production, although an appreciable amount already is being done. Dependent upon the basic industries, such as steel, for materials to use in reconversion.

Mueller Furnace Co.—An official said: "The firm's war work was entirely foreign to its pre-war business but the work was done in certain parts of the plant. Present bottlenecks in production of heating and air conditioning controls lie in motors,

A "MARRIAGE CEREMONY" PERFORMED WITH HELE-SHAW FLUID POWER

Projectiles are fitted with "driving bands." The main, but not the only, function of these bands is to rotate the shell.

Years ago the bands were rolled on, later pressed on mechanically. Now most bands are squeezed on hydraulically. One slight pull on a 2-way valve lever and powerful "fingers" compress the ring about the shell. Another pull and springs return the plungers to "open", ready for the next squeeze. Pressure at two or three shell positions and the job is done—fast!

Hele-Shaw Fluid Power with its high oil pressure, ease of control and operation, is made to order for machines of this type. Learn all of the advantages of Hele-Shaw Fluid Power and go hydraulic on your next job.

THE HELE-SHAW

Fluid Power

PUMP

OTHER Æ PRODUCTS:
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In any plant, there are a dozen places where Spencer Vacuum could speed up and improve special operations, and at the same time reduce costs.

In the boiler room, soot is removed from tubes without blowing. Efficiencies are increased as much as 20%.

Cocoa shells and crumbs are removed from ovens in chocolate plants and bakeries. Chips are removed at the tool on delicate machining operations. Molds for castings weighing many tons are cleaned with a special Spencer vacuum tool. All this without blowing, without loss of time and with very low operating and maintenance costs. Ask for the Bulletins.

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SPENCER VACUUM CLEANING

THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

controls and steel. The firm could use more employes.

Koehring Co.—An official said: No reconversion problem is expected. The chances are the firm will increase its employment if it can find workers because it is short the number felt necessary under the program designed for civilian work.

Compare Employment

The Association of Commerce postwar planning division confirmed individual firm reports Saturday when it disclosed that its latest survey shows that in the postwar period Milwaukee industry wiuld employ 118,142 people compared to a war peak of 148,233 in November, 1943, and a prewar total of 67,429 in February, 1939. Total postwar employment of both industry and commercial firms is estimated by the division following a recent survey, at 250,000 compared to estimates in 1944 of 248,500, a war peak in 1943 of 290,700 and a 1940 total of 194,874.

A final encouraging note is offered by the survey made under the division's supervision by such organizations as Rotary, the Downtown association and Sales Managers' association of contemplated postwar business expenditures for new construction, machinery, equipment and remodeling. The final tabulation showed that 1,439 firms planned to spend $78,419,843 for such purposes in the first two years after the war.

Buffalo Bolt Has No Reconversion Tooling Task

Buffalo

• • • Cancellations of war orders held by the Buffalo Bolt Co. have been offset by a considerable volume of business from a wide variety of industries undergoing reconversion to peace time operations, according to President Rudolph B. Flershem.

He pointed out that the company's wartime production was accomplished with equipment equally adaptable to "the tasks of peace," and therefore the transition from war to peace production involved no retooling problems.

The S. L. Jones Co. of Toledo, a subsidiary, is preparing to expand operations in the oil well supply field as manpower and raw materials become increasingly available. The Eclipse Lawn Mower Co. of Prophetstown, Ill., another subsidiary, is resuming the manufacture of hand and power-driven lawn mowers.

"It's Steel!"

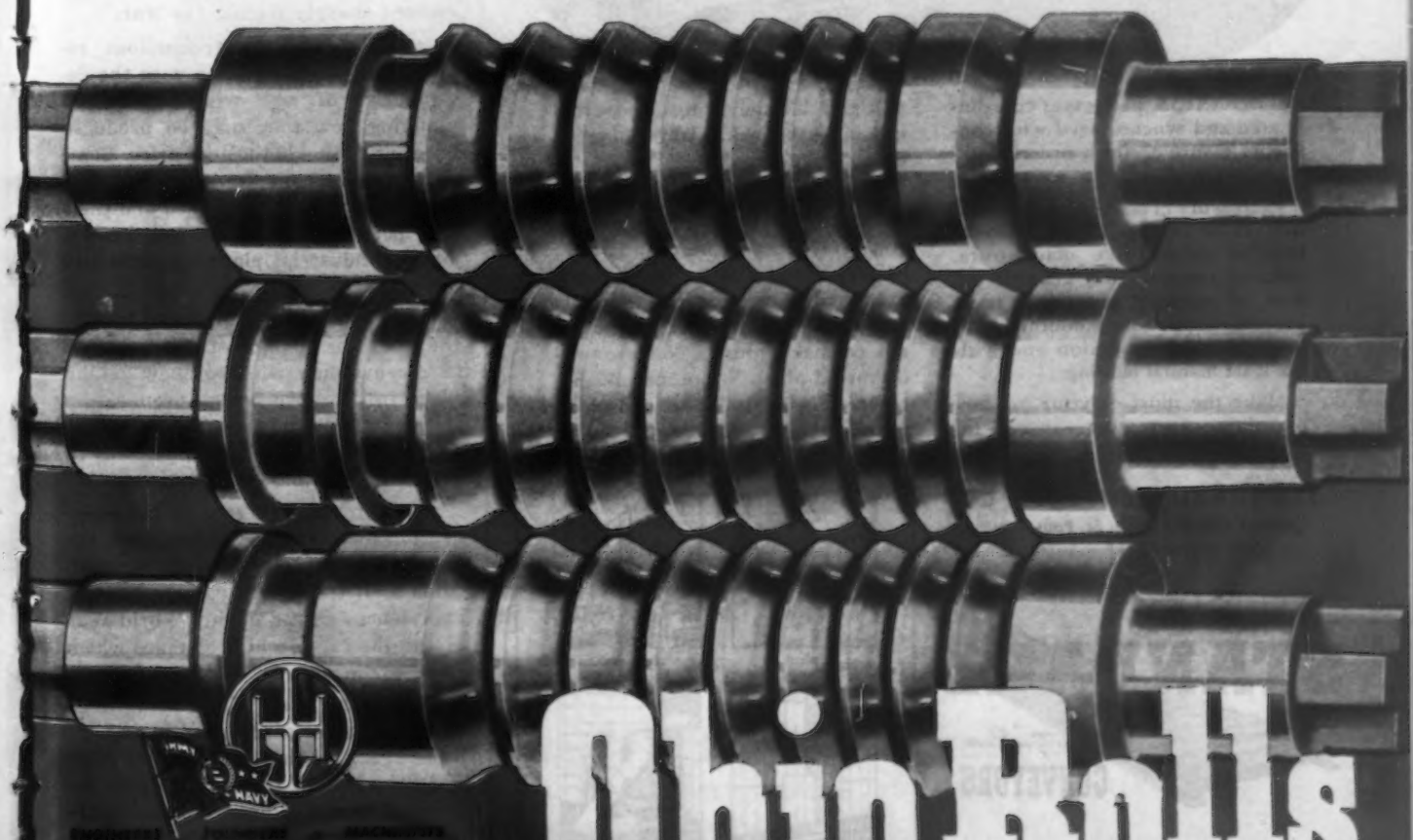
What more is there to say?

Unqualified, the merits of steel have been proved in thousands of applications, from steam shovels to washing machines.

The net result is a market that is waiting impatiently for articles made from steel—and they'll accept no substitute.

Logically, then, steel must be produced in quantities never before paralleled in the history of peacetime production.

Obviously, rolls will also be needed in proportion to this demand. It is Ohio Steel's intention to produce these rolls—*right* and in a minimum of time.



Ohio Rolls

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AN ORDERLY CONVEYOR-COORDINATED PLANT BESPEAKS AN EFFICIENT PLANT!

PRODUCTION processes coordinated and synchronized with conveyors assure a clean, orderly, efficient plant.

Conveyors break the bottle-necks that cause confusion, congestion, loss of productive man-hours, reduced output. They channel the flow of material and products in process—work flows smoothly without halt or interruption and with the least manual hauling.

Make the most of your productive time—manpower—space—investigate all the things conveyors can do—the many ways they can earn money for you.

Standard builds roller, belt, chain, slat, push-bar, power and gravity conveyors, spiral chutes, portable pilers, pneumatic tube systems. Standard Conveyor Company is equipped by experience and facilities to make yours a conveyor coordinated plant. Write for valuable reference book "Conveyors by Standard," Catalog No. IA-95

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Munition's Board Gets Next Conflict Planning Duties

Washington

• • • The Army and Navy Munitions Board has been directed by President Truman to take over the postwar assignment of planning for industrial mobilization in the event of future threats to world peace.

This means that the board will become one of the key agencies in the defense program to be adopted to safeguard the security of the United States after the present wartime military establishment is demobilized.

One of the important postwar functions of the board will be to coordinate the procurement and other current industrial activities of the Army and Navy. Joint procurement by the two services has expanded greatly during the war.

The board will not only coordinate the current joint procurement and procurement planning of the two departments, but will also direct and supervise the work of all the joint Army-Navy boards and committees dealing with industrial matters. The number of these agencies has increased sharply during the war.

It will also have tremendous responsibility in connection with the development of new weapons and in planning how they may be produced in quantity should the need arise. Some of these weapons were just coming into use when the war ended and their full potentiality is not yet known, making industrial planning extremely difficult.

Assignment of the postwar task to the board is a part of the program of reconversion which is now taking place in the government preparatory to the liquidation of wartime agencies and the shifting of their functions to regular peacetime organizations.

As a preliminary step in the preparation for assuming its new task, the board is at present being reconstituted and strengthened in the light of experiences gained during World War II and the far-reaching changes which seem to lie ahead.

The Army and Navy Munitions Board was originally activated in June 1922, by the Secretary of War and Secretary of the Navy to plan industrial mobilization for war purposes. It functioned under a letter agreement until July 1, 1939, when President Roosevelt signed an order

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J&L Controlled Quality Sheets help you keep your fabricating running smoothly and economically. Made from J&L Controlled Quality Steel—product of science and skill, piloted by research.

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MILFORD DUPLEX HACK SAW BLADES

For straight line cutting . . . in corners or angles . . . or in tubing . . . MILFORD DUPLEX with EASY-STARTING TEETH are the answer.

There's no delay and spoilage from poor starts. With MILFORD . . . it's one push and the cut is started on the line. Even with tubing, you get easy, smooth cutting . . . no hanging up or binding in the side walls.

This Duplex feature is but one of the outstanding reasons for cutting superiority built into MILFORD HACK SAW BLADES in over sixty-five years of exclusive saw manufacturing.

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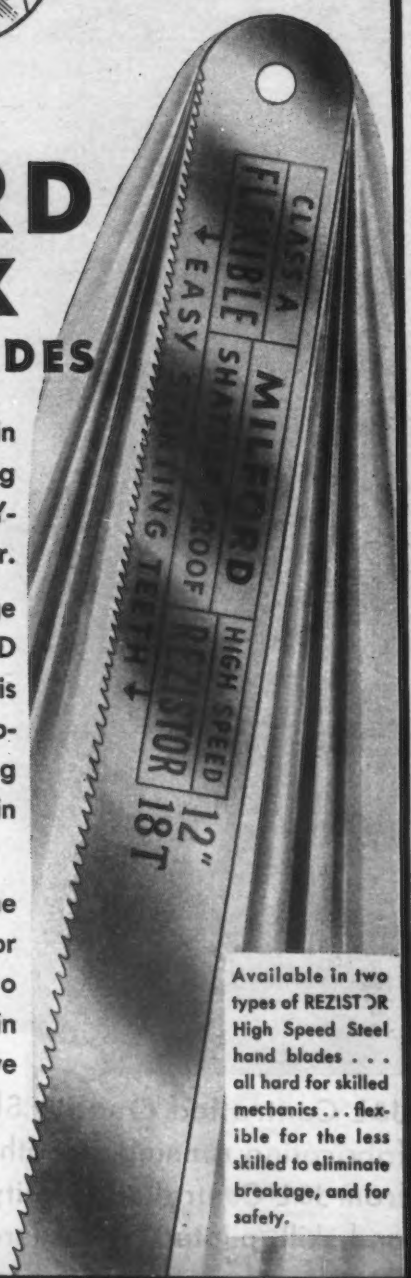

Available in two types of REZISTOR High Speed Steel hand blades . . . all hard for skilled mechanics . . . flexible for the less skilled to eliminate breakage, and for safety.

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placing the board under his direction and supervision as Commander-in-Chief.

The board formulated the Industrial Mobilization Plan of 1939 which was made available to the agencies later assigned the task of mobilizing the resources of the country for war.

After the start of the war the board worked with the War Production Board and other agencies on current Army-Navy problems such as stockpiling strategic materials and determining priorities.

As a result of the increased responsibilities of the board, the President has directed that a civilian executive chairman be appointed to assume active direction of the Board's operations.

The executive chairman will be named by the Undersecretary of War and the Assistant Secretary of the Navy in the near future. He will be a man of proved ability and probably one who has been active in industrial mobilization during the war.

The board will report directly to the President through the Secretary of War and the Secretary of the Navy.

German Requisitions Reduced Italy's Steel

Washington

• • • **Steel plants** in northern Italy suffered relatively little war damage, and in May production was being held up chiefly because of the lack of raw materials, according to Italian press reports received by the Dept. of Commerce.

In 1943, Italy produced 1,750,000 quintals of iron and steel products a month. At the end of 1943, however, the Germans began interfering with production and requisitioning manufactured articles. As a result the output gradually dropped until it was only about 200,000 quintals during the first four months of 1945. Estimates place the monthly needs of the steel industry at approximately 500,000 quintals of unworked steel and about 250,000 quintals of coal. Electric furnaces are used for the most part.

The plants of the heavy steel industry in the Liguria region, which were only slightly damaged during the war, are said to have reserves of iron ore, steel, and cast iron. The amount of their production will be dependent on whether they are able to obtain adequate supplies of coal.

SHAFER "DE" 22000 Bearings

The Self-Contained, Self-Aligning Self-Centering ROLLER BEARING with *Raceways like a Ball*

Watch the curved raceways in Shafer ConCaVex Self-Aligning Bearings—with the rollers curved to match—if you want to know the secret of the extraordinary records Shafer Self-Aligning Bearings have established in their more than 25 years' service to the Industry of America. Only the basic Shafer design, Shafer's patented construction, combines the advantages of a ball and a roller in one and the same bearing. Only bearings of the successful Shafer design are inherently immune to end and radial thrust, to shaft deflection and misalignment, to load shocks. Ask the men who use them.

1. SHAFER "DE" 22000 SERIES
The self-contained bearing, preadjusted, ready to install. Has one piece outer race, two rows of rollers and single inner race for compactness. Maximum capacity.

2. SHAFER DOUBLE ROW BEARING ASSEMBLY
for building into machines, power transmission equipment, etc. Two outer races, two roller assemblies. A single inner race.

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One outer race, one row of rollers, one inner race. Self-aligning with radial and thrust load capacity.

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When dissolved in water, TROXIDE removes rust and scale from ferrous, non-ferrous and precious metals. TROXIDE's action slows when clean metal is reached . . . thereby reducing the danger of overpickling. And while it is working, TROXIDE protects workers and equipment from acid hazards by spreading a blanket of safety, called "PROTECTOFOAM," over the pickling solution, preventing the escape of acid particles into the air, and returning them to the solution for useful work.

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Non-inflammable and non-eruptive, TROXIDE in solution forms a combination of the sulphuric and muriatic acid types. A TROXIDE solution equal to the conventional acid-bath cleans a bigger surface area . . . without the acid hazards of the ordinary pickling solution.

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TROXIDE

SUPPLIERS — *East:* Safety & Maintenance Co., Inc., New York 1, N. Y. *South, Midwest & West:* Waverly Petroleum Products Co., Philadelphia 6, Pa.

Goodrich Releases Details of Newest Thermoset Plastic

Cleveland

• • • A new non-flammable thermoset plastic with high optical and electrical properties, good resistance to abrasion and high resistance to oils and greases and most chemicals, including acids and alkalies, is announced by B. F. Goodrich Chemical Co., Cleveland. The new material has been named KRISTON.

The product, one of a series of new thermosetting resins, is formed by polymerizing liquid monomer in the presence of a suitable catalyst. Low temperatures and no pressure are required.

KRISTON monomer is a somewhat viscous, water-clear, anhydrous liquid having a specific gravity of 1.25 which can be cast in simple molds. It sets to a hard, heat resistant plastic. No water or other volatile products are released during the polymerization, making easy the preparation of dense, non-porus articles. Shrinkage during polymerization is said to be low.

The material can be made into a water-clear plastic or made in a wide range of colors which can be transparent, translucent or opaque. It has high dielectric strength and electrical resistivity, and promises to find many valuable applications in the electrical field. Its resistance to abrasion is reported to be much higher than the thermoplastics, making possible its use in places where plastics heretofore have been unsuitable.

In its cast states KRISTON is odorless, tasteless, nontoxic and dimensionally stable. After molding KRISTON can be worked on standard machining and polishing equipment.

Some immediate applications which have been suggested for KRISTON polymer are in the electrical industry, where its electrical and physical characteristics suggest its use in making insulators, control knobs, handles, panels, or other molded insulating parts, especially in the high frequency range; the chemical and processing industries where its imperviousness to corrosive materials and solvents should make it valuable in fabricating parts for equipment, such as, valves, pumps, agitators, controls, or for any equipment exposed to corrosive fumes, vapors and liquids; and as a low pressure laminant for paper, fabrics and wood for mechanical services.

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The new Shell Tellus Oils are not designed to *remove* rust. They will not eliminate all existing rusting conditions that may be present in your machines. But, where moisture is a factor, the new Shell Tellus Oils, because of the special rust inhibiting qualities built into them, afford unequalled protection against the formation of rust. At the same time, moving parts are lubricated and protected against wear.

In addition to helping prevent rust, Shell Tellus Oils have other valuable assets. For example, they have high oxidation stability. This prevents sludge, keeps viscosity uniform, and enables the oil to shed moisture throughout long periods of service.

Still another advantage of this oil is its high viscosity index, which prevents wide fluctuation in oil viscosity with varying temperatures.

* * *

Why not try this new-type oil? It is available in a number of grades, providing necessary viscosity ranges for all normal applications. For details, get in touch with Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL

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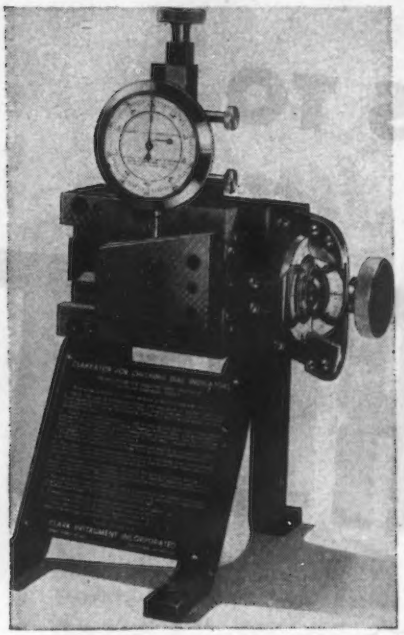

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CLARK

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Simplified Practice For Certain Steel Shapes Now Ready

Washington

• • • A voluntary Simplified Practice Recommendation for hot-rolled carbon-steel structural shapes, as proposed by the technical committee on carbon steel plate and structural shapes, of the American Iron & Steel Institute, will be made available, during the month of September, to all intrests, for their consideration, comment and approval, according to an announcement of the Division Simplified Practice of the National Bureau of Standards.

The proposal, containing 18 tables, covers the nominal sizes, and weights per linear foot of: sections; beams; stanchions; joists; channels, angles; tees, and zees. Sections and angles used in carbuilding and shipbuilding are included.

The benefits derived from the use of a simplified list of structural steel shapes, during the war, are so pronounced, that it is felt that a retention of that list, with some modifications, should result in widespread advantage to all concerned, in normal times.

The purpose of this program, therefore, is to establish a voluntary Simplified Practice Recommendation which lists those structural shapes that have the greatest usage. Among the benefits to be derived from the general adoption of this recommendation are: increased production, through less frequent roll-changes in the mills; reduction in the inventories of fabricators, warehouses, and manufacturers; and improved service to the ultimate consumer.

For reason that as many firms as posible should be given an opportunity to examine the proposed recommendation, the readers of this announcement are invited to make known their interest, by writing to the Division of Simplified Practice, National Bureau of Standards, Washington, 25, D. C. The names of all firms that are not already on the Division's mailing list of representative firms,—small, medium and large; and widely distributed, geographically, — will be added immediately.

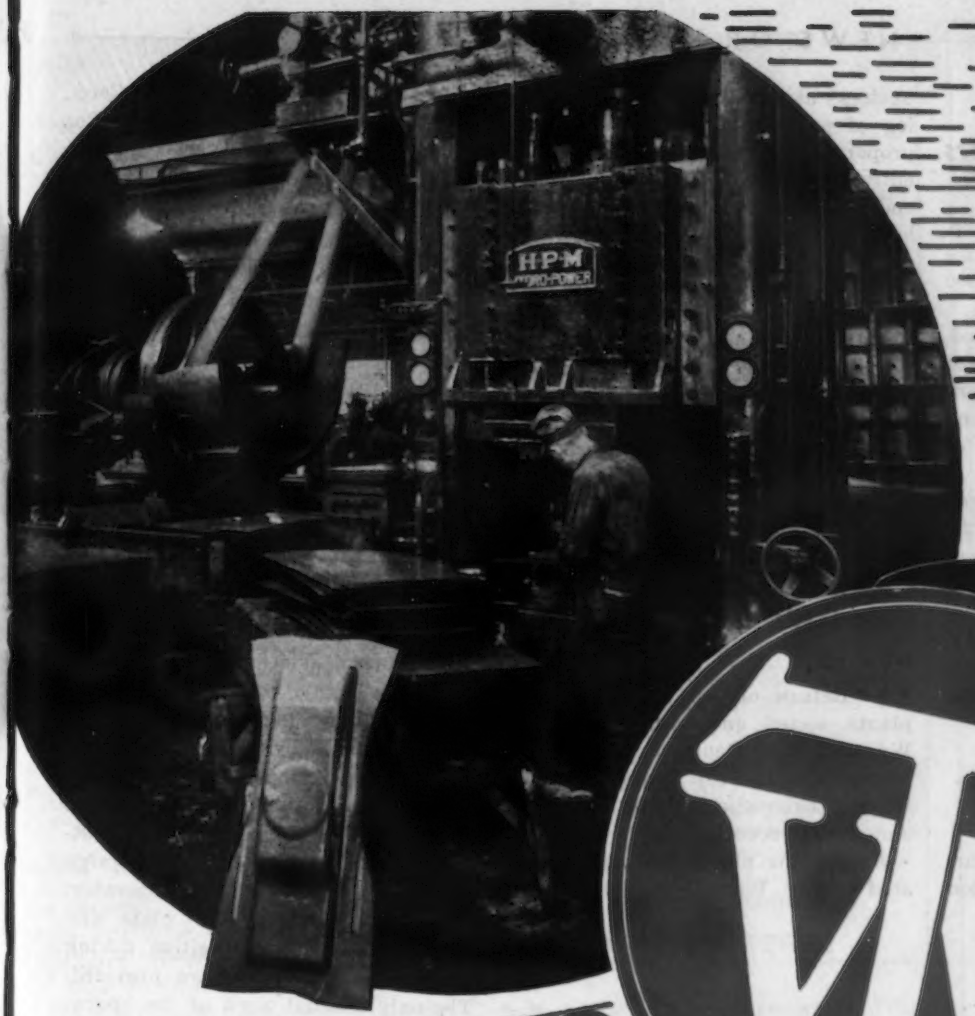
Phelps Dodge Builds Midwestern Wire Mill

New York

• • • The Phelps Dodge Copper Products Corp. has announced the start of construction of a $4.5 million rod, wire and cable plant at Ft. Wayne, Ind. The plant will occupy a 31-acre site.

The purpose in establishing a plant at this location is considered to be an effort to hold postwar freight rates between the mines, mill and midwestern consumers including public utilities to a minimum.

FINAL PAY: *Line forms all around the Wright Aeronautical Corp., plant at Wood Ridge, N. J., for the last pay check. 17,000 were laid off at this plant, with the company planning to return the facility to the government.*



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● Your economical assembly costs with T&W Deep Drawn Stampings may be traced to four things at Transue's—knowledge, experience, workmanship and adequate facilities. Double action presses up to 650 tons, auxiliary presses of many types, pickling, continuous annealing, welding, and other facilities make the Transue plant exceptionally well equipped. Large users of deep drawn stampings recognize this and depend on the resultant quality and uniformity of T & W parts.

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SWPC Surveying Needs Of Machine Tool Users

Washington

• • • **The Smaller War Plants Corp.** is currently surveying the machine tool needs of approximately 35,000 small metal-working firms.

After the survey is completed, SWPC will try to find in government surpluses the particular machinery wanted by each small producer and notify him regarding the location of the equipment.

SWPC also plans to use the survey to help small business by showing the demand for many different types of machine tools.

If the small producer wishes to buy a tool that has been located, SWPC can lend him money for the purchase, or it may exercise its priority to buy it for him.

Reconversion Going Smoothly

Cincinnati

• • • **The district machine tool market is pressing into reconversion business as rapidly as possible. Backlog of peacetime business is in fair proportion, with operations apparently insured well toward the year's end. New business is also reported to be in satisfactory volume, but, of course, sharply off from the heavy wartime ordering. Except for retrenchment done immediately after V-J Day, and some prior to that, local plants have not reduced production much further. In fact, in many instances, additional skilled men are being employed and plants are proceeding at present capacity operations.**

OES Approves Return Of Ten Seized Plants

Washington

• • • **Return of ten privately-owned plants seized and operated by the War and Navy Depts. during the war emergency has been approved by the Office of Economic Stabilization it was announced recently.**

Among the plants that have operated under War Dept. jurisdiction were the Farrell-Cheek Steel Corp., Sandusky, Ohio; Hughes Tool Co., Houston, Tex.; S. A. Woods Co., South Boston, Mass.; and Cocker Machine & Foundry Co., Gastonia, N. C.

The Navy Dept. also has terminated operation of the United Engineering Co., San Francisco.

The Farrell-Cheek Steel Corp. has been operated by the War Dept. since Sept. 25, 1944, because production was interrupted due to a labor disturbance resulting from the management's refusal to comply with an order of the National War Labor Board.

Edge Preparation Of Ship Plate

(CONTINUED FROM PAGE 63)

The plates are kept in contact with the roller base by their own weight. And, the power-operated rolls forming the planer table move the plates ahead from receiving section to cutting section and then to discharge section, at the will of the operator. Means for squaring the plate and holding it in proper position during the cutting operations are provided. The only manual work of the operator consists of the proper initial positioning of the bridge carriages which carry the flame cutting heads.

The significant conclusions drawn from the foregoing analysis may be summarized as follows:

(1) This unorthodox manner of preparing plates came closer to theoretical perfection than any before achieved.

(2) The process overcame, to a large extent, limitations caused by the human factor in bringing new ease and speed to production.

(3) Plate distortion was counteracted by flame-cutting component plate edges simultaneously.

(4) Shell plate edge preparation by the utilization of mechanical cams, as a pre-requisite to highest quality welding, permits trim cutting of plate edges to any desired contour and combination of bevels within the limits of ±0.003 in.

In conclusion, this development is a prime illustration of how assembly line production is taking hold of the shipbuilding industry due chiefly to the realization of the economics of prefabrication.

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The strength, finish, rhythm and smooth, rapid operation of Universal Precision Balls have gained the full confidence of the most meticulous ball users.

These successful businessmen know by experience of the uniform quality balls produced in this modern plant. Because here the equipment is of latest design. The management and personnel are taught preciseness, and are all dedicated to the science of producing unexcelled precision balls.

For this reason, Engineers, Designers, Superintendents and Purchasing Officials are invited to inspect every department of this exclusive ball plant.

Once you see this plant where balls only (not bearings) are made, you, too, will specify Universal Precision Balls the next time you need precision balls of extra fine tolerance and surface finish. Balls that are guaranteed 100% inspected and individually gauged, with a sphericity and size accuracy that will reduce friction, wear and maintenance costs to an absolute minimum.

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PRODUCTS OF

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Tractors to Keep Massey-Harris Co. At Present Level

Racine, Wis.

• • • Employment at the Massey-Harris Co. local factory is expected to stay around the present 1,600 level compared with the prewar 1,200 and eventually will convert its 33-acre army tank division to increased tractor production. The present 11-acre tractor factory is working night and day to keep up with the vastly increased farm machinery demand.

While Massey-Harris was told by Army Ordnance to stop production on tanks on Aug. 11, that portion of the contract dealing with the M-41 tank was reinstated. Formerly a military secret, the M-41, or 155 millimeter howitzer motor carriage, combines the light tank chassis with a major field artillery piece. Carrying a five man crew, the 19-ton M-41 can travel 35 miles an hour, powered by twin V-8 engines.

Worker Shortage Remains Despite Payrolls Dropping

Buffalo

• • • Factory employment in 173 area plants dropped 4,302 to 91,259 in July, the Buffalo Chamber of Commere reports. The total was 25,611 below that for July 1944.

Average weekly payrolls for July were $5,003,970, compared with $5,251,108 in June, and $6,149,908 a year ago. Average weekly earnings were $54.83, against $54.95 in June, and $52.62 in the corresponding month of last year.

"Reconversion is well under way in a number of the city's leading plants," the report noted. "Non-manufacturing industries are absorbing large numbers of those released from war goods plants and there still are many opportunities for employment in the non-manufacturing field.

"There still is a shortage of workers in steel mills, railroads, foundries and heavier metal industries."

School Construction Planned

Buffalo

• • • Canisius High School plans to build a four-story, 24-room addition to the former Consistory in Delaware Ave. at a cost of $200,000. The work is scheduled to begin as soon as materials are available for the brick-and-stone structure which will double the classroom capacity.

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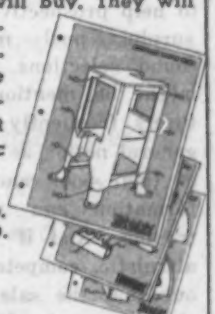
Have you thought about using more arc welding in your post-war production? More and more manufacturers see the value of arc welding for producing vital war materials . . . they know what it can do. We at Hobart value their judgment . . . not only from the standpoint of more arc welding . . . but for the type of welding equipment they will buy. They will compare all welding machines . . . feature for feature . . . and their decision will be Hobart "Simplified" Arc Welding.



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MACHINE TOOLS

. . . News and Market Activities

Surpluses Cloud Machine Tool Picture; Foreign Inquiries Heavy

Cleveland

• • • Reconversion of the machine tool industry as a whole is going well. Foreign inquiries, principally from France and Belgium, are coming in, and the possibilities of China, a vast unknown in export equations, are being investigated. Price ceilings are due for review, and shipments, tangibly indexing the excitement, promise to surpass $400,000,000 this year at the present rate.

Strange as it may seem, however, failure of the government-owned surplus to put in anything like a full scale appearance dims the present market's roseate glow. Simply because these machines, about which so little is actually known, constitute potential competition until disposition has been made.

Some companies have already gone on record with the long range and realistic attitude on this problem, namely, to raise the machine efficiency of American industry first. Hence, these companies are anxious to help prospective customers of the surplus pool make economically sound selections. In this regard it might be mentioned that manufacturers frequently have more than a general notion as to the whereabouts of their pool machines and this information can save a purchaser trouble. And if this seems utterly altruistic, competent observers point out that the sale of a surplus machine opens the door for a new order in two years.

According to reports, many purchasers of surplus machines have found, after calling for appraisal by the manufacturers, that the cost of bringing their newly acquired equipment up to the point of profitable operation would exceed the original cost. Such cases can hardly be assumed to represent the true picture, but having undergone the magnifying process of being rumored around, they do suggest that advice will be required in numerous cases. Also, there is little doubt that many of the government-owned machines will have to be reconverted themselves, and while this see-saw of trial and error is taking place, it is to be hoped that the lemons will be scrapped.

Some machine tool big-wigs feel that the surplus machines should not be sold abroad, even in the event that American industry is unwilling to absorb them at desirable prices, until they have been put in new condition and can be guaranteed accordingly. But, among the foreign buyers there is little apparent interest. Russia doesn't want them and France doesn't either. There is always China, whose potential is now being examined, but prices are high in terms of freight to the Far East. Informed sources report that the Chinese have been advised to buy new machines and T. V. Soong & Co., are supposed to have a sizeable inquiry in.

It has been predicted, perhaps optimistically, that the government will take over more of the surplus machines than was originally anticipated. However, cases are being reported to the Surplus Property Board where employers desire to make immediate purchases of standard general purpose tools in order to hasten the reemployment of their people in peacetime production. SPB has been advised that there is a great abundance of such tools and has asked RFC to set aside sufficient numbers of them to satisfy the needs of federal and state agencies including Smaller War Plants Corp., thereby satisfying the priority provisions of the statute, so that sales may be made in compliance with SPB Regulation 2, section 8302.5.

SPB would like to have this procedure utilized in order to expedite reconversion. Information required by the board must yet be assembled, but the mere formal preparation of statements should not delay the essential disposition of these tools. If nothing else, this suggests that somebody, somewhere, must have some idea of what the government and state requirements will be.

Stuart Symington, SPB chairman, attested to the nebulous nature of the surplus in Washington last week before the National Assn. of Business Paper Editors. Said Mr. Symington, whose conclusions seemed somewhat obvious, "We've got so much of it we don't know anything about it . . . we'll go ahead as the act stands at least during the 90-day period . . . But with 285,000 priorities in one section, the act will require courageous interpretations . . . A practical approach is necessary . . .

Cleveland companies are invariably reporting that August is practically in the record books as a better month than July, which was the low point on shipments for builders everywhere ($32,000,000) and unfilled orders, among other things. Industrywide, unfilled orders now stand at $235,000,000 and as of July shipments totaled $267,000,000.

Peak shipments during the war exceeded $100,000,000 (achieved through extensive subcontracting) and as the plants stand now, they are probably geared to $60,000,000 a month. From this it can be seen that shipments of even $30,000,000 a month will entail a considerable trimming. Unless Uncle Sam begins giving machines to European nations under one agreement or another, shipments certainly wont reach $400,000,000 in 1946. Shipments will eventually drop to $200,000,000 a year or even less.

Reconversion of the machine tool industry itself has meant little more than the return to small lots, which is an expensive way to make machines. But with most builders unwilling to predict what will happen in two years, pessimists in the industry are quick to see what they think is the handwriting on the wall by using the rule of thumb that five years of good business for the country will still only mean three for the machine tool makers.

See p. 198 for more Machine Tool News.

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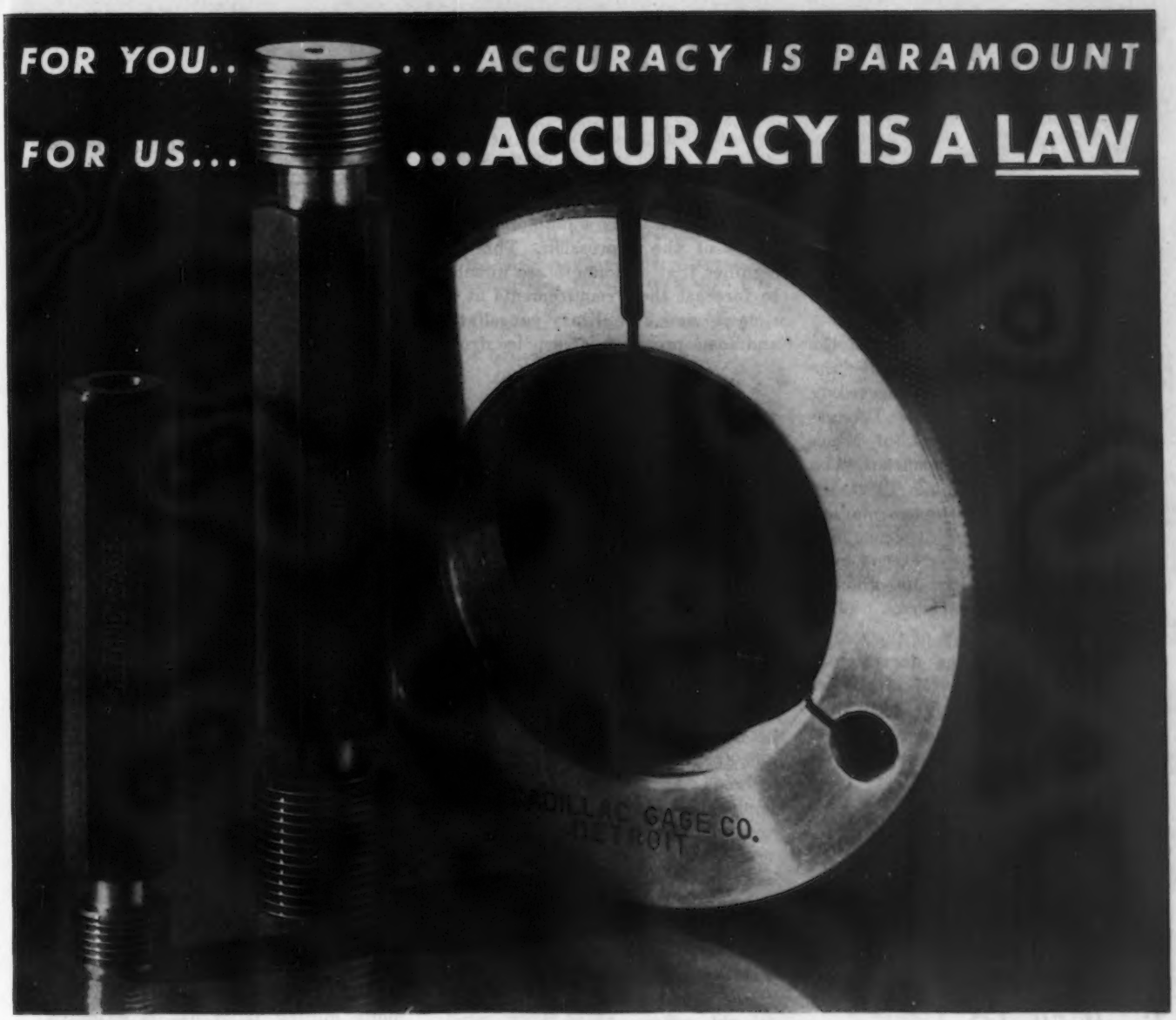
FOR US... ...ACCURACY IS A LAW



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NONFERROUS METALS

. . . News and Market Activities

Brazilian Magnesite Deposits Thought Large

Rio de Janeiro

• • • **The magnesite** deposits of the state of Ceará could supply the world's needs indefinitely, according to a report by Othon Henry Leonardos of the National Dept. of Mines and Metallurgy. Dr. Leonardos, who has just returned from an extensive survey of the state, estimates magnesite resources there at over one billion tons. These deposits extend over a distance of more than 100 kilometers between Orós and Cairús.

Prior to the discovery of the Ceará magnesite reserves, the deposits of Brumado in the state of Bahia were the largest in Brazil, being estimated at several hundred million tons, with some of the mineral in almost pure state and part containing from 1 to 4 pct of iron oxide. The mines also contained beautiful transparent magnesite crystals, some weighing 500 grams. The company, Magnesita S. A., authorized to operate in 1940, located two deposits in Bahia with estimated reserves of 400 million tons each.

•

Zinc Unfilled Orders Drop Sharply in August

New York

• • • **Shipments of slab zinc** during August have dropped to 48,307 short tons which compares with a peak of 94,000 tons in March, more than double the present rate. Production during August totalled 64,753 tons, a thousand tons less than last month and well below the peak production of 86,000 tons in March, 1944. Production is permitted to continue at a high rate due to the effect of the premium payment plan which tends to shield marginal producers from the effects of declining consumer activity. In the meantime reserves of slab zinc are building up to a point approaching last November's peak figure of 246,000 tons. At the end of August stocks had reached 213,504 tons, according to the American Zinc Institute.

A most significant item is the drop in unfilled orders at the end of March to 9211 tons, a figure which is comparable with orders on hand at the depth of the depression. This drop signifies that consumers are unwilling to forecast their requirements at this time in view of military cancellations and some prospects of a price drop.

•

Titan Metal Will Act As Brass Export Agent

Bellefonte, Pa.

• • • **The Titan Metal Mfg. Co.**, Bellefonte, Pa., has established an International Division with headquarters at 70 Pine St., New York. Jean Paul Elkann will assume the direction of the company's export activities at this office. Titan operates four plants in Bellefonte and specializes in the manufacture of copper-base alloy rods, forgings, die castings and welding rods. It is expected that Titan should be in a position to offer through its sales representatives abroad an even more complete line than the one manufactured by the company. Manufacturers of nonferrous metals and finished products made of nonferrous metals, who would be interested in developing export sales are invited to communicate with this office.

•

Scrap Demand Weak

New York

• • • **Aluminum scrap** continues to be selling at a nominal price range this week with orders reported to be small and scattered. Under the circumstances it is difficult to establish market prices inasmuch as ingot producers are generally out of the market.

In brass and bronze scrap, OPA groups No. 1 and 2 are selling at about ¼¢ per lb below ceiling prices and remelters are said to be willing to absorb offerings since there is not a large quantity on the market. However, OPA groups No. 3 and 4 consisting of fired rifle shells, brass pipe, condenser tubes, manganese bronze, refinery brass, etc., are not in demand. While OPA prices are quoted for these scrap items, these prices are merely nominal as there are no purchasers.

Tighter WPB Restrictions Anticipated on Lead

New York

• • • **WPB officials** are about ready to release a revision to the lead order M-38 restricting authorized uses for lead to an even greater extent than heretofore. Officials point out that this order is made necessary by continuing stringency of lead supply and a high rate of peacetime consumption. It is expected that there may be some improvement in this situation when scrap reclamation gets into full swing, but it would seem that large quantities of battery lead will continue in use until military equipment becomes obsolescent.

•

Increases in Antimony Supplies Not Expected

New York

• • • **The shortage of antimony** is expected by WPB officials to continue despite the fact that peace has been declared and China is theoretically in a position to make shipment of antimony once again. This is accounted for by the current Chinese economy and the effect of inflation upon antimony mining labor. It is expected that the miners, having become accustomed to a relatively high income, will be reluctant to continue again at prewar rates at any foreseeable future time. On the other hand our ceiling price is expected to be maintained and should tend to prevent imports of Chinese antimony.

Meanwhile, our sole source of supply in this country remains the Texas Smelting and Refining Co. at Laredo, Tex., which is engaged in the refining of Latin-American ores.

•

Mercury Down Again

• • • **Dealers in mercury** report little or no buying of this metal at this time and while under the circumstances it is difficult to establish a market quotation it is reported that the price might have gone as low as $102 to $104 per flask, dependent on quantity. Some West Coast producers have shut down their operations. There is not much business for imported mercury at this time, it is said.

Primary Metals

(Cents per lb., unless otherwise noted)

Aluminum, 99+%, del'd (Min. 10,000 lb.)	15.00
Aluminum pig	14.00
Antimony, American, Laredo, Tex.	14.50
Beryllium copper, 3.75-4.25% Be; dollars per lb. contained Be	$17.00
Cadmium, del'd	90.00
Cobalt, 97-99% (per lb.)	$1.50 to $1.57
Copper, electro, Conn. valley	12.00
Copper, electro, New York	11.75
Copper, lake	12.00
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$3.00
Iridium, dollars per troy oz.	$120.00
Lead, St. Louis	6.35
Lead, New York	6.50
Magnesium, 99.9 + %, carlots	20.50
Magnesium, 12-in. sticks, carlots	27.50
Mercury, dollars per 76-lb. flask, f.o.b. New York	$102-$104
Nickel, electro	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per oz.	$85.00
Silver, open market, New York, cents per oz.	44.75
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.65

Remelted Metals

(Cents per lb. unless otherwise noted)

Aluminum, No. 12 Fdy. (No. 2)	9.00 to 10.00
Aluminum, deoxidizing No. 2, 3, 4	$6.00 to 9.50
Brass Ingot	
85-5-5-5 (No. 115)	13.25
88-10-2 (No. 215)	16.75
80-10-10 (No. 305)	16.00
No. 1 Yellow (No. 405)	10.25

Copper, Copper Base Alloys

(Mill base, cents per lb.)

	Extruded Shapes	Rods	Sheets
Copper	20.87	....	20.37
Copper, H.R.	....	17.37	....
Copper drawn	....	18.37	....
Low brass, 80%	....	20.40	20.15
High brass	....	....	19.48
Red brass, 85%	....	20.61	20.36
Naval brass	20.37	19.12	24.50
Brass, free cut	....	15.01	....
Commercial bronze, 90%	....	21.32	21.07
Commercial bronze, 95%	....	21.53	21.28
Manganese bronze	24.00	....	28.00
Phos. bronze, A, B, 5%	....	36.50	36.25
Muntz metal	20.12	18.87	22.75
Everdur, Herculoy, Olympic or equal	....	25.50	26.00
Nickel silver, 5%	....	28.75	26.50
Architect bronze	19.12	....	....

Aluminum

(Cents per lb., subject to extras on gage, size, temper, finish, factor number, etc.)

Tubing: 2 in. O.D. x 0.065 in. wall 2S, 40c. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier: 2S and 3S, 21.2c.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness: 2S and 3S, 22.7c. a lb.; 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base for tubing; 30,000-lb. base for plate, flat stock.

Extruded Shapes: "As extruded" temper; 2000-lb. base, 2S and 3S, factor No. 1 to 4, 25.5c.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 28c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by weight per lineal foot.

Wire Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ¼ in., 24c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths, 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Magnesium

Sheet, rod, tubes, bars, extruded shapes subject to individual quotations. Metal turnings: 100 lb. or more, 46c. a lb.; 25 to 99 lb., 56c.; less than 25 lb., 66c.

NONFERROUS SCRAP METAL QUOTATIONS

†(OPA basic maximum prices, cents per lb., f.o.b. point of shipment, subject to quality, quantity and special preparation premiums—other prices are current quotations)

Copper, Copper Base Alloys

OPA Group 1†

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
No. 2 copper borings	8.75
Lead covered copper wire, cable	6.00*
Lead covered telephone, power cable	6.04
Insulated copper	5.10*

OPA Group 2†

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50*
Low lead bronze borings	11.50*
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00*
High lead bronze borings	10.00*
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Contaminated gilded metal solids	8.00
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25
Automobile radiators	7.00
Zincy bronze borings	8.00
Zincy bronze solids	8.00

OPA Group 3†

Fired rifle shells	8.25
Brass pipe	7.50
Old rolled brass	7.00
Admiralty condenser tubes	7.50
Muntz metal condenser tubes	7.00
Plated brass sheet, pipe reflectors	6.50
Manganese bronze solids	7.25[1]
Manganese bronze solids	6.25[2]
Manganese bronze borings	6.50[2]

OPA Group 4†

Refinery brass	4.75*

*Price varies with analysis. [1] Lead content 0.00 to 0.40 per cent. [2] Lead content 0.41 to 1.00 per cent.

Other Copper Alloys

Briquetted Cartridge Brass Turnings	8.62½
Cartridge Brass Turnings, Loose	7.87½
Loose Yellow Brass Trimmings	7.87½

Aluminum*

Plant scrap, segregated

2S solids	8.00
Dural alloys, solids 14, 17, 18, 24S	4.50
25S turnings, dry basis	3.00
Low copper alloys 51, 52, 61, 63S solids	7.50
turnings, dry basis	5.75

Plant scrap, mixed

Solids	4.00
Turnings, dry basis	2.75

Obsolete scrap

Pure cable	8.00
Old sheet and utensils	6.00
Old castings and forgings	5.00
Pistons, free of struts	5.00
Pistons, with struts	3.00
Old alloy sheet	5.00

Magnesium*

Segregated plant scrap

Pure solids and all other solids, exempt	
Borings and turnings	1.50

Mixed, contaminated plant scrap

Grade 1 solids	3.00
Grade 1 borings and turnings	2.00
Grade 2 solids	3.00
Grade 2 borings and turnings	1.00

*Nominal.

Zinc

New zinc clippings, trimmings	6.50
Engravers, lithographers plates	6.50
Old zinc scrap	4.75
Unsweated zinc dross	5.00
Die cast slab	4.50
New die cast scrap	4.48
Radiator grilles, old and new	3.50
Old die cast scrap	3.00

Lead

Deduct 0.55c. a lb. from refined metal basing point prices or soft and hard lead including cable, for f.o.b. point of shipment price.

Nickel

Ni content 98+%, Cu under ½%, 26c. per lb.; 90 to 98% Ni, 26c. per lb contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point in 500 lb lots)

Copper, frt. allowed	
Cast, oval, 15 in. or longer	35½
Electrodeposited	18⅞
Rolled, oval, straight	19½
Curved	20⅝
Brass, 80-20, frt. allowed	
Cast, oval, 15 in. or longer	23⅝
Zinc, cast, 99.99, 15 in. or longer	16¼
Nickel, 99 per cent plus, frt. allowed	
Cast	47
Rolled, depolarized	48
Silver, 999 fine	
Rolled, 1-9 troy oz., per oz.	58*

Chemicals

(Cents per lb., f.o.b. shipping point)

Copper cyanide, 1-5 bbls.	34.00
Copper sulphate, 99.5, crystals, bbls.	7.75
Nickel salts, single, 425 lb. bbls., frt. allowed	13.50
Silver cyanide, 100 oz. lots	—.417*
Sodium cyanide, 96 per cent, domestic, 100 lb. drums	15.00
Zinc cyanide, 100 lb. drums	33.00
Zinc sulphate, 99 per cent, crystals, bbls., frt. allowed	6.35

*Price based on use of foreign silver.

Turnings Drop in Some Markets

New York

• • • Factors in the scrap industry who may have been anticipating a serious decline in the market this week are doomed to disappointment since openhearth grades in all districts continue at ceiling prices. However, there are some significant changes in blast furnace scrap grades, with Chicago, Detroit, St. Louis, New York and Birmingham dropping appreciable amounts. It might be well to reiterate, however, that the market this week is by no means going into a sharp decline.

However, it is true that buying by consumers is being carried out on a limited basis with mills eagerly scanning developments in the news to guide their subsequent purchasing activities. Scrap movement throughout the country continues remarkably slow with producers' and dealers' activities curtailed to minimums.

While a decline in scrap prices has long been anticipated, especially after the drop in the rate of steel ingot production, the curtailment of volume of producer scrap because of war cutbacks apparently has made the supply just about balance the demand. Actually, the only weakness in price has been in turnings and unprepared. As to unprepared, yards have neither the manpower nor the time to handle it and are turning it away. The weakening of turnings prices is the natural result of less buying at the mills, since as soon as steel mills can get better scrap than turnings for openhearth charges, the use of turnings in the openhearth drops off. Thus, turnings become a blast furnace item entirely.

●

PITTSBURGH—The market here continues fairly firm on a definitely thin basis. Very little buying is evidenced, and at the same time there are no offerings of any consequence. As a result, rather good balance is achieved at present price levels, with all factors looking at the situation cautiously and awaiting forward developments. Allocations on railroad scrap are still coming to local offices. Unprepared scrap is definitely in weaker ground.

●

CHICAGO—First confirmation of weakness in blast furnace grades came with a small mill purchase of cast iron borings and mixed borings and turnings at $13.00. With expiration of outstanding mill orders for short shoveling turnings at ceiling within the next two weeks, future mill interest in that item may reflect some weakness. Local mill interest in machine shop turnings is nil but balers continue to offer ceiling and are encountering difficulty in securing requirements. One out-of-district mill order, bringing the local ceiling with springboard, reached the local market last week. On prime openhearth grades, brokers are busy filling large orders taken at ceiling a fortnight ago.

●

PHILADELPHIA—The scrap market here continues quiet. Mills are exhibiting caution in their buying of openhearth grades. Turnings are scarce and shipments have not been sufficiently heavy to suit the mills. Cast demand is still strong and pipe foundries that heretofore suffered from a dearth of labor are now facing the problem of insufficient cast scrap. Unprepared scrap is plentiful but little prepared scrap is being offered. The labor picture is spotty. Yards in outlying districts are still short of manpower while those in central locations have been able to hire new workers. Ceiling prices continue for all grades of scrap but unprepared scrap has felt a slight decline in price.

●

BUFFALO—Lack of new demand for steelmaking and blast furnace scrap had no effect on prices last week. Deliveries of turnings on outstanding contracts rose sharply as expiration dates neared but dealers still were well-heeled with orders for heavier material. The leading consumer continued to reach out for scrap with 2500 tons arriving by Canal from the New York City area last week and a similar shipment due this week. Large purchases of short shoveling and blast furnace have been made at ceilings this week. As much as 25,000 tons is on order for delivery by Canal before the freeze sets in.

●

NEW YORK—Turnings dropped to a range of $875. to $975. this week with no change in openhearth grades which remain at ceilings. Scrap movement continues slow with no new orders being placed but orders in existence are reported to be sizable and adequate for current operating rates. Cast scrap is still very scarce.

●

CLEVELAND—Despite reported shipments into the Pittsburgh district, the scrap supply here is apparently far from plentiful and prices continue at ceilings. Generally, the market is quiet, with one sale of 5000 tons of turnings and openhealth scrap to one of the major consumers reported. Presumably, mill inventories are in fair condition, although another major consumer was reported to be using his own bundles.

●

BOSTON—Prices for heavier materials are firm at ceilings, but those for borings and turnings give every evidence of breaking wide open. Concessions of 50¢ a ton by holders of the latter are reported to have been offered without having induced buying. Consumers have taken to the sidelines awaiting further developments. On the other hand chemical borings as well as foundry material are in active demand at full ceiling prices.

●

ST. LOUIS—Cutbacks and cancellations of war contracts have resulted in a shorter supply of industrial scrap iron in the St. Louis area. Railroad supply also has been cut because of labor shortage. Steel mills bought a round tonnage of heavy melting steel at ceiling prices because of falling demand. Machine shop turnings are off $2.25 a ton for the same reason. Steel car axles declined $2 a ton.

●

CINCINNATI—The market while not aggressively active, appears to have an underlying strength and prices are unchanged. Dealers indicate, however, that bidding on low cost material is liable to indicate an unwillingness to pay too high prices on the government releases. On the whole, however, both buyers and sellers in the market are wary, and such trading as is going on is largely for current necessary production.

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BIRMINGHAM—The placing of orders for material has been resumed here but a spirit of caution on the part of consumers still exists. Openhearth grades continue to bring ceiling prices but without any freight springboard.

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Institute Views Postwar Prospects; Plans Convention

Washington, D. C.

• • • The Institute of Scrap Iron & Steel, Inc., is planning its 18th annual convention, Jan. 8, 9 and 10, at St. Louis. Looking into postwar prospects for scrap dealers, which the Institute believes will be good, the convention will emphasize the preparation of scrap, particularly those problems arising from the enforced absorption of government surpluses and alloy scrap.

The business program will originate with the national office of the Institute, according to E. C. Barringer, president and executive secretary. Entertainment features will be provided by the St. Louis chapter through its convention planning board. A. P. Ashner and Jack Gordon are chairman and co-chairman, respectively, of this board. Other members are the chairmen of the various committees that have been specially created, including Jack R. Forcheimer, Gus Gillerman, Sam Lefton, Sam Shanfeld and Alvin A. Wolff.

The Jefferson Hotel will be headquarters for the convention.

Going prices as obtained in the trade by IRON AGE editors, based on representative tonnages. Where asterisks are used on quotations below, this indicates a ceiling price to which must be added brokerage fee and adjusted freight.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. melting	$20.00*
RR. hvy. melting	21.00*
No. 2 hvy. melting	20.00*
RR. scrap rails	21.50*
Rails 3 ft. and under	23.50*
No. 1 comp'd sheets	20.00*
Hand bdld. new shts.	20.00*
Hvy. axle turn.	19.50*
Hvy. steel forge turn.	19.50*
Mach. shop turn.	14.00 to 15.00
Short shov. turn.	17.00*
Mixed bor. and turn.	15.00*
Cast iron borings	16.00*
Hvy. break cast.	16.50*
No. 1 cupola	20.00*
RR. knuck. and coup.	24.50*
RR. coil springs	24.50*
Rail leaf springs	24.50*
Rolled steel wheels	24.50*
Low phos. bil. crops	25.00*
Low phos.	22.50*
RR. malleable	22.00*

CHICAGO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.75*
No. 2 hvy. melting	18.75*
No. 1 bundles	18.75*
No. 2 dealers' bndls.	18.75*
Bundled mach. shop turn.	18.75*
Galv. bundles	16.75*
Mach. shop turn.	13.75*
Short shovel. turn.	15.75*
Cast iron borings	$12.50 to 13.00
Mix. borings & turn.	12.50 to 13.00
Low phos. hvy. forge	23.75*
Low phos. plates	21.25*
No. 1 RR. hvy. melt.	19.75*
Reroll rails	22.25*
Miscellaneous rails	20.25*
Rails 3 ft. and under	22.25*
Locomotive tires, cut	22.75 to 23.25
Cut bolsters & side frames	20.25 to 21.25
Angles & splice bars	22.25*
Standard stl. car axles	25.00 to 25.50
No. 3 steel wheels	23.25*
Couplers & knuckles	23.25*
Agricul. malleable	22.00*
RR. malleable	22.00*
No. 1 mach. cast.	20.00*
No. 1 agricul. cast.	20.00*
Hvy. breakable cast.	16.50*
RR. grate bars	15.25*
Cast iron brake shoes	15.25*
Stove plate	19.00*
Clean auto cast.	20.00*
Cast iron carwheels	20.00*

CINCINNATI

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.50*
No. 2 hvy. melting	19.50*
No. 1 bundles	19.50*
No. 2 bundles	19.50*
Mach. shop turn.	$10.50 to 11.00
Shoveling turn.	12.50 to 13.00
Cast iron borings	11.50 to 12.00
Mixed bor. & turn.	11.50 to 12.00
Low phos. plate	22.00*
No. 1 cupola cast.	20.00*
Hvy. breakable cast.	16.50*
Stove plate	19.00*
Scrap rails	21.00*

BOSTON

Dealers' buying prices per gross ton, f.o.b. cars

No. 1 hvy. melting	$15.05*
No. 2 hvy. melting	15.05*
No. 1 and 2 bundles	15.05*
Busheling	15.05*
Turnings, shovelings	12.05*
Machine shop turn.	10.05*
Mixed bor. & turn.	10.05*
Cl'n cast, chem. bor.	13.06 to 14.15*

Track delivery to foundry

Machinery cast	21.00 to 23.51*
Breakable cast	21.57 to 21.87*
Stove plate	20.00 to 22.51*

DETROIT

Per gross ton, brokers' buying prices:

No. 1 hvy. melting	$17.32*
No. 2 hvy. melting	17.32*
No. 1 bundles	17.32*
New busheling	17.32*
Flashings	17.32*
Mach. shop turn.	$11.50 to 12.00
Short shov. turn.	13.00 to 14.32
Cast iron borings	12.75 to 13.32
Mixed bor. & turn.	12.75 to 13.32
Low phos. plate	19.32*
No. 1 cupola cast.	20.00*
Charging box cast.	19.00*
Hvy. breakable cast.	16.50*
Stove plate	19.00*
Automotive cast	20.00*

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.75*
No. 2 hvy. melting	18.75*
No. 2 bundles	18.75*
Mach. shop turn.	13.75*
Shoveling turn.	15.75*
Cast iron borings	13.50 to 14.00
Mixed bor. & turn.	13.75*
No. 1 cupola cast	20.00*
Hvy. breakable cast	16.50*
Cast, charging box	19.00*
Hvy. axle forge turn.	18.25*
Low phos. plate	21.25*
Low phos. punchings	21.25*
Billet crops	21.25*
RR. steel wheels	23.25*
RR. coil springs	23.25*
RR. malleable	22.00*

ST. LOUIS

Per gross ton delivered to consumer:

Heavy melting	$17.50*
Bundled sheets	17.50*
Mach. shop turn.	$9.00 to 9.50
Locomotive tires, uncut	18.00
Misc. std. sec. rails	19.00*
Rerolling rails	21.00*
Steel angle bars	21.00*
Rails 3 ft. and under	21.50*
RR. springs	22.00*
Steel car axles	21.50
Stove plate	19.00*
Grate bars	15.25*
Brake shoes	15.25*
RR. malleable	22.00*
Cast iron carwheels	20.00*
No. 1 mach'ery cast	20.00*
Breakable cast	16.50*

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting	$17.00*
No. 2 hvy. melting	17.00*
No. 2 bundles	17.00*
No. 1 busheling	17.00*
Long turnings	$9.50 to 10.00
Cast iron borings	11.00 to 11.50
Bar crops and plate	17.50 to 18.00
Structural and plate	17.50 to 18.00
No. 1 cast	20.00*
Stove plate	17.00
Steel axles	18.00*
Scrap rails	18.50
Rerolling rails	20.50*
Angles & splice bars	18.50 to 19.00
Rails 3 ft. & under	21.00*
Cast iron carwheels	16.50 to 17.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. melting	$20.00*
No. 2 hvy. melting	20.00*
Low phos. plate	22.50*
No. 1 busheling	20.00*
Hydraulic bundles	20.00*
Mach. shop. turn.	15.00*
Short shovel. turn.	17.00*
Cast iron borings	16.00*

NEW YORK

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$15.33*
No. 2 hvy. melting	15.33*
Comp. black bundles	15.33*
Comp. galv. bundles	13.33*
Mach. shop turn.	$8.75 to 9.75
Mixed bor. & turn.	8.75 to 9.75
Shoveling turn.	12.33*
No. 1 cupola cast	20.00*
Hvy. breakable cast	16.50*
Charging box cast	19.00*
Stove plate	19.00*
Clean auto cast	20.00*
Unstrip. motor blks.	17.50*
Cl'n chem. cast bor.	14.33*

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.25*
No. 1 bundles	19.25*
No. 2 bundles	19.25*
No. 2 hvy. melting	19.25*
Mach. shop turn.	14.25*
Shoveling turn.	16.25*
Cast iron borings	15.25*
Mixed bor. & turn.	14.25*
No. 1 cupola cast	20.00*
Stove plate	19.00*
Low phos. plate	21.75*
Scrap rails	20.75*
Rails 3 ft. & under	22.75*
RR. steel wheels	23.75*
Cast iron car wheels	20.00*
RR. coil & leaf spgs.	23.75*
RR. knuckles & coup.	23.75*
RR. malleable	22.00*
No. 1 busheling	19.25*

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.50*
No. 2 hvy. melting	19.50*
Compressed sheet stl.	19.50*
Drop forge flashings	19.00*
No. 2 bundles	19.50*
Mach. shop turn.	14.50*
Short shovel.	16.50*
No. 1 busheling	19.50*
Steel axle turn.	19.00*
Low phos. billet and bloom crops	24.50*
Cast iron borings	15.50*
Mixed bor. & turn.	14.50*
No. 2 busheling	17.00*
No. 1 machine cast	20.00*
Railroad cast	20.00*
Railroad grate bars	15.25*
Stove plate	19.00*
RR. hvy. melting	20.50*
Rails 3 ft. & under	23.00*
Rails 18 in. & under	24.25*
Rails for rerolling	23.00*
Railroad malleable	22.00*
Elec. furnace punch	22.00*

SAN FRANCISCO

Per gross ton delivered to consumer:

RR. hvy. melting	$16.00
No. 1 hvy. melting	16.00
No. 2 hvy. melting	15.00
No. 2 bales	$13.50 to 14.25
No. 3 bales	9.50 to 10.59
Mach. shop turn.	7.00
Elec. furn. 1 ft., und.	15.50 to 17.00
No. 1 cupola cast	19.00 to 21.00

LOS ANGELES

Per gross ton delivered to consumer:

No. 1 hvy. melting	$14.50 to $15.50
No. 2 hvy. melting	13.50 to 14.50
No. 2 bales	12.50 to 13.50
No. 3 bales	9.00 to 10.00
Mach. shop turn.	4.50
No. 1 cupola cast	19.00 to 21.00

SEATTLE

Per gross ton delivered to consumer:

RR. hvy. melting	$13.50
No. 1 hvy. melting	13.50
No. 2 bundles	11.50
Elec. furn. 1 ft., und.	17.00
No. 1 cupola cast	20.00*

Comparison of Prices . .

Advances over past week in **Heavy Type**; declines in *Italics*. Prices are f.o.b. major basing points. The various basing points for finished and semifinished steel are listed in the detailed price tables.

Flat-Rolled Steel: (cents per pound)	Sept. 11, 1945	Sept. 4, 1945	Aug. 7, 1945	Sept. 12, 1944
Hot-rolled sheets	2.20	2.20	2.20	2.10
Cold-rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.70	3.70	3.70	3.50
Hot-rolled strip	2.10	2.10	2.10	2.10
Cold-rolled strip	2.80	2.80	2.80	2.80
Plates	2.25	2.25	2.25	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terneplate: (dollars per base box)				
Tinplate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tinplate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (cents per pound)				
Merchant bars	2.25	2.25	2.25	2.15
Cold-finished bars	2.75	2.75	2.75	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (cents per pound)				
Bright wire	2.75	2.75	2.75	2.60
Wire nails	2.90	2.90	2.90	2.55
Rails: (dollars per gross ton)				
Heavy rails	$43.00	$43.00	$43.00	$40.00
Light rails	45.00	45.00	45.00	40.00
Semifinished Steel: (dollars per gross ton)				
Rerolling billets	$36.00	$36.00	$36.00	$34.00
Sheet bars	36.00	36.00	36.00	34.00
Slabs, rerolling	36.00	36.00	36.00	34.00
Forging billets	42.00	42.00	42.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (cents per pound)				
Wire rods	2.15	2.15	2.15	2.00
Skelp	1.90	1.90	1.90	1.90

Pig Iron: (per gross ton)	Sept. 11, 1945	Sept. 4, 1945	Aug. 7, 1945	Sept. 12, 1944
No. 2 foundry, Phila.	$26.84	$26.84	$26.84	$25.84
No. 2, Valley furnace	25.00	25.00	25.00	24.00
No. 2, Southern, Cin'ti	25.44	25.44	25.44	24.44
No. 2, Birmingham	21.38	21.38	21.38	20.38
No. 2 foundry, Chicago†	25.00	25.00	25.00	24.00
Basic, del'd eastern Pa.	26.34	26.34	26.34	25.34
Basic, Valley furnace	24.50	24.50	24.50	23.50
Malleable, Chicago†	25.00	25.00	25.00	24.00
Malleable, Valley	25.00	25.00	25.00	24.00
L. S. charcoal, Chicago	42.34	42.34	42.34	37.34
Ferromanganese‡	135.00	135.00	135.00	135.00

† The switching charge for delivery to foundries in the Chicago district is 60¢ per ton.
‡ For carlots at seaboard.

Scrap: (per gross ton)				
Heavy melt'g steel, P'gh	$20.00	$20.00	$20.00	$18.25
Heavy melt'g steel, Phila.	18.75	18.75	18.75	17.00
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.32	17.32	17.32	14.75
Low phos. plate, Youngs'n	22.50	22.50	22.50	20.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	22.50
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Chicago	20.00	20.00	20.00	22.17
Coke, Connellsville: (per net ton at oven)				
Furnace coke, prompt	$7.50	$7.50	$7.50	$7.00
Foundry coke, prompt	9.00	9.00	9.00	8.25
Nonferrous Metals: (cents per pound to large buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake	12.00	12.00	12.00	12.00
Tin, Straits, New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	14.50	14.50	14.50	14.50

Composite Prices . .

Starting with the issue of Apr. 22, 1943, the weighted finished steel index was revised for the years 1941, 1942 and 1943. See explanation of the change on p. 90 of the Apr. 22, 1943 issue. Index revised to a quarterly basis as of Nov. 16, 1944; for details see p. 98 of that issue. The finished steel composite prices for the current quarter are an estimate based on finished steel shipments for the previous quarter. These figures will be revised when the actual data of shipments for this quarter are compiled.

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Sept. 11, 1945	2.41571¢ a pound	$24.61 a gross ton	$19.17 a gross ton
One week ago	2.41571¢ a pound	$24.61 a gross ton	$19.17 a gross ton
One month ago	2.41571¢ a pound	$24.61 a gross ton	$19.17 a gross ton
One year ago	2.30837¢ a pound	$23.61 a gross ton	$18.00 a gross ton

	HIGH	LOW	HIGH	LOW	HIGH	LOW
1945	2.41571¢ May 29	2.21189¢ Jan. 2	$24.61 Feb. 20	$23.61 Jan. 2	$19.17	$19.17
1944	2.30837¢ Sept. 5	2.21189¢ Oct. 5	$23.61	$23.61	19.17	$15.67 Oct. 24
1943	2.25513¢	2.25513¢	23.61	23.61	19.17	$19.17
1942	2.26190¢	2.26190¢	23.61	23.61	19.17	$19.17
1941	2.43078¢	2.43078¢	$23.61 Mar. 20	$23.45 Jan. 2	$22.00 Jan. 7	$19.17 Apr. 10
1940	2.30467¢ Jan. 2	2.24107¢ Apr. 16	23.45 Dec. 23	22.61 Jan. 2	21.83 Dec. 30	16.04 Apr. 9
1939	2.35367¢ Jan. 3	2.26689¢ May 16	22.61 Sept. 19	20.61 Sept. 12	22.50 Oct. 3	14.08 May 16
1938	2.58414¢ Jan. 4	2.27207¢ Oct. 18	23.25 June 21	19.61 July 6	15.00 Nov. 22	11.00 June 7
1937	2.58414¢ Mar. 9	2.32263¢ Jan. 4	23.25 Mar. 9	20.25 Feb. 16	21.92 Mar. 30	12.67 June 8
1936	2.32263¢ Dec. 28	2.05200¢ Mar. 10	19.74 Nov. 24	18.73 Aug. 11	17.75 Dec. 21	12.67 June 9
1935	2.07642¢ Oct. 1	2.06492¢ Jan. 8	18.84 Nov. 5	17.83 May 14	13.42 Dec. 10	10.33 Apr. 29
1934	2.15367¢ Apr. 24	1.95757¢ Jan. 2	17.90 May 1	16.90 Jan. 27	13.00 Mar. 13	9.50 Sept. 25
1933	1.95578¢ Oct. 3	1.75836¢ May 2	16.90 Dec. 5	13.56 Jan. 3	12.25 Aug. 8	6.75 Jan. 3
1932	1.89196¢ July 5	1,83901¢ Mar. 1	14.81 Jan. 5	13.56 Dec. 6	8.50 Jan. 12	6.43 July 5
1931	1.99626¢ Jan. 13	1.86586¢ Dec. 29	15.90 Jan. 6	14.79 Dec. 15	11.33 Jan. 6	8.50 Dec. 29
1930	2.25488¢ Jan. 7	1.97319¢ Dec. 9	18.21 Jan. 7	15.90 Dec. 16	15.00 Feb. 18	11.25 Dec. 9
1929	2.31773¢ May 28	2.26498¢ Oct. 29	18.71 May 14	18.21 Dec. 17	17.58 Jan. 29	14.08 Dec. 3

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 pct of the United States output. Index recapitulated in Aug. 28, 1941 issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

. . . Prices of Finished Iron and Steel

Steel prices shown here are f.o.b. basing points, in cents per pound unless otherwise indicated. Extras apply. Delivered prices do not reflect 3 pct tax on freight. (1) Mill run sheet, 10¢ per 100 lb under base; primes, 25¢ above base. (2) Unassorted commercial coating. (3) Widths up to 12-in. inclusive. (4) 0.25 carbon and less. (5) Applies to certain width and length limitations. (6) For merchant trade. (7) For straight length material only from producer to consumer. Discount of 25¢ per 100 lb to fabricators. (8) Also shafting. For quantities of 20,000 to 39,999 lb. (9) Carload lot in manufacturing trade. (10) Prices do not apply if rail and water is not used. (11) Boxed. (12) This base price for annealed, bright finish wires, commercial spring wire. (13) Produced to dimensional tolerances in AISI Manual Sect. 6. For price exceptions to finished and semi-finished steels turn several pages.

Basing Points	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars [10]	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot-rolled	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.30¢	2.30¢		2.75¢	2.30¢	2.44¢	2.37¢
Cold-rolled [1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 gage)	3.70¢	3.70¢	3.70¢		3.70¢	3.70¢	3.70¢	3.70¢	3.80¢	3.70¢		4.25¢		3.94¢	3.87¢
Enameling (20 gage)	3.45¢	3.45¢	3.45¢	3.45¢			3.45¢		3.55¢	3.45¢		4.10¢	3.55¢	3.81¢	3.77¢
Long ternes [3]	3.80¢	3.80¢	3.80¢									4.55¢		4.16¢	4.12¢
STRIP															
Hot-rolled [3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold-rolled [4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester=3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.30¢							2.56¢	
Commodity cold-rolled	2.95¢	3.05¢		2.95¢			2.95¢	(Worcester=3.35¢)					3.05¢	3.31¢	
TINPLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
Electro, box 0.25 lb	$4.35	$4.35	$4.35												
Electro, box 0.50 lb	$4.50	$4.50	$4.50						$4.60						
Electro, box 0.75 lb	$4.65		$4.65						$4.75						
BLACKPLATE															
29 gage [6]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢ [11]			3.37¢
TERNES, MFG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢		(Duluth=2.35¢)			2.60¢	2.90¢	2.35¢	2.59¢	2.57¢
Rail steel [8]	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢					2.60¢	2.90¢			
Reinforcing (billet) [7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.35¢	2.39¢	
Reinforcing (rail) [7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.35¢		2.47¢
Cold-finished [8]	2.75¢	2.75¢	2.75¢	2.75¢		2.75¢		(Detroit=2.80¢)			(Toledo=2.90¢)			3.09¢	3.07¢
Alloy, hot-rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton=2.70¢)					2.80¢		
Alloy, cold-drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Contesville and Claymont=2.25¢)							
Carbon steel [13]	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢		2.25¢	2.25¢			2.60¢	2.80¢	2.47¢	2.44¢	2.30¢
Floor plates	3.50¢	3.50¢									3.85¢	4.15¢		3.96¢	3.82¢
Alloy	3.50¢	3.50¢			(Coatesville=3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem=2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 carbon	2.80¢			2.80¢			(Worcester=3.00¢)								
0.51 to 0.75 carbon	4.30¢			4.30¢			(Worcester=4.50¢)								
0.76 to 1.00 carbon	6.15¢			6.15¢			(Worcester=6.35¢)								
1.01 to 1.25 carbon	8.35¢			8.35¢			(Worcester=8.55¢)								
WIRE [9]															
Bright [12]	2.75¢	2.75¢		2.75¢	2.75¢		(Worcester=2.85¢)		(Duluth=2.80¢)			3.25¢			3.07¢
Galvanized	Add proper size extra and galvanizing extra to Bright Wire base														
Spring (high carbon)	3.35¢	3.35¢		3.35¢			(Worcester=3.45¢)					3.85¢			3.67¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢

SEMIFINISHED STEEL

Ingots, Carbon, Rerolling

Base per gross ton, f.o.b. mill.... $31.00

Ingots, Carbon, Forging

Base per gross ton, f.o.b. Birmingham, Buffalo, Chicago, Cleveland, Gary, Pittsburgh, Youngstown $36.00

Ingots, Alloy

Base per gross ton, f.o.b. Bethlehem, Buffalo, Canton, Coatesville, Chicago, Massillon, Pittsburgh $45.00

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; delivered E. Michigan, $3.00 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12.00 higher. Provo, $11.20 higher. Delivered prices do not reflect 3 pct tax on freight rates.

Per Gross Ton

Rerolling $36.00
Forging 42.00

Alloy Billets, Blooms, Slabs

Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem, per gross ton $54.00

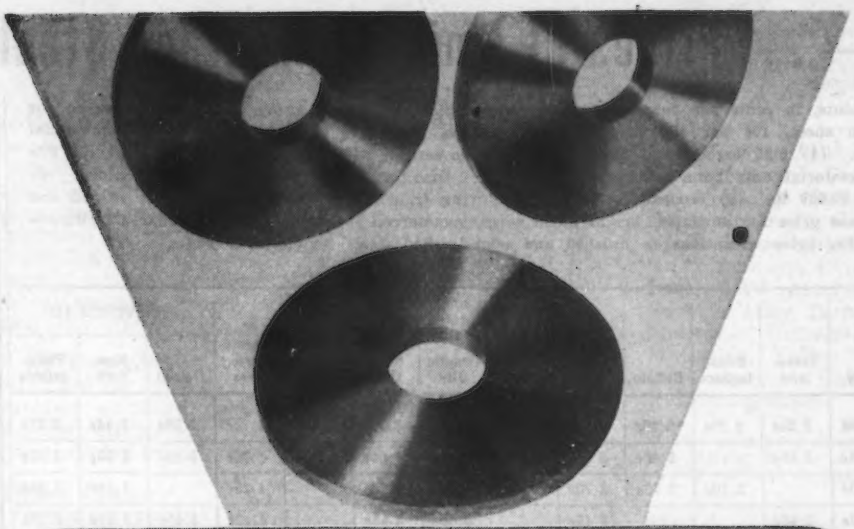
Price delivered Detroit $2.00 higher; East Michigan, $3.00 higher.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point.

Per Gross Ton

Openhearth or bessemer $36.00



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Ampco's wealth of experience in the field of non-ferrous alloys, led to the development of high conductivity alloys used in the Resistance Welding Industry.

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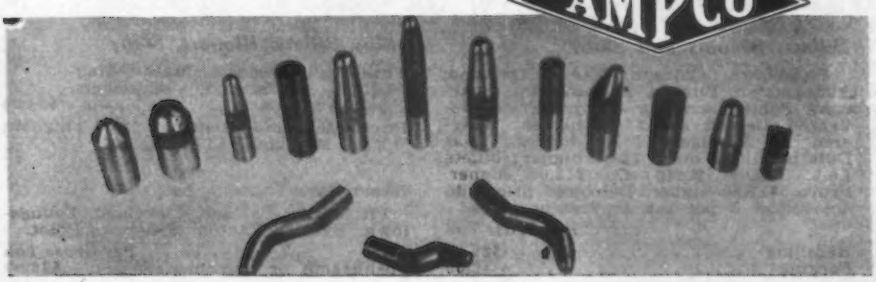

PRICES

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.15c.
Worcester, Mass.	2.25c.
Birmingham	2.15c.
San Francisco	2.65c.
Galveston	2.40c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Shell Steel

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham.

Prices delivered Detroit are $2.00 higher; East Michigan, $3 higher.

Price Exceptions: Follansbee Steel Corp. permitted to sell at $13.00 per gross ton, f.o.b. Toronto, Ohio, above base price of $52.00.

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$43.00
Angle splice bars, 100 lb.	2.70
(F.o.b. Basing Points)	*Per Gross Ton*
Light rails (from billets)	$45.00
Light rails (from rail steel)	44.00
	Base per Lb.
Cut spikes	3.25c.
Screw spikes	5.40c.
Tie plate, steel	2.30c.
Tie plates, Pacific Coast	2.45c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing points, light rails, Pittsburgh, Chicago, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa., Richmond, Oregon and Washington ports, add 25c.

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 3c. higher.

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham, Duluth

	Basing Points Named	*Pacific Coast Basing Points†*
	Base per Keg	
Standard wire nails	$2.90	$3.40
Coated nails	2.90	3.40
Cut nails, carloads	3.85	....
	Base per 100 Lb.	
Annealed fence wire	$3.05	$3.55
Annealed galv. fence wire	3.40	3.90
	Base Column	
Woven wire fence*	67	85
Fence posts, carloads	69	86
Single loop bale ties	66	91
Galvanized barbed wire**	72	82
Twisted barbless wire	72	....

*15½ gage and heavier. **On 80-rod spools in carload quantities.

†Prices subject to switching or transportation charges.

WAREHOUSE PRICES

Delivered metropolitan areas per 100 lb. These are zoned warehouse prices in conformance with latest zoning amendment to OPA Price Schedule 49.

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	Hot Rolled, NE 8617-20	Hot Rolled, NE 9442-45 Ann.	Cold Drawn, NE 8617-20	Cold Drawn, NE 9442-45 Ann.
**Philadelphia	$3.518	$4.872[5]	$4.768[5]	$3.922	$4.772	$3.605	$3.966	$3.822	$4.172	$5.816	$6.866	$7.072	$8.172
New York	3.59	4.813[2]	5.110	3.974[6]	4.772	3.768	3.758	3.853	4.203	5.858	6.908	7.103	8.203
Boston	3.744	4.744[9]	5.224[9]	4.108	4.715	3.912	3.912	4.044	4.244	6.012	7.062	7.194	8.394
Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.152	....	....	....	....
Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.265	....	....	....	....
Chicago	3.25	4.20	5.231	3.60	4.66[17]	3.55	3.55	3.50	3.85	5.60	6.65	6.85	7.90
Milwaukee	3.387	4.337[3]	5.272[4]	3.737	4.787[17]	3.687	3.687	3.537	3.987	5.737	6.887	6.887	7.987
Cleveland	3.35	4.40	4.877[4]	3.60	4.45	3.40	3.568	3.35	3.85	5.806	6.856	6.65	7.78
Buffalo	3.35	4.40	4.754	3.819	4.669	3.83	3.40	3.35	3.85	5.60	6.65	6.65	7.75
Detroit	3.45	4.50	5.004	3.70	4.859[17]	3.609	3.661	3.45	3.90	5.93	6.98	6.959	8.059
Cincinnati	3.425	4.475[3]	4.825[3]	3.675	4.711	3.661	3.921	3.611	4.111	5.95	7.00	7.011	8.261
St. Louis	3.397	4.347[3]	5.172[4]	3.747	4.931[17]	3.997	3.697	3.647	4.131	5.981	7.031	7.031	8.131
Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.85	5.60	6.65	6.65	7.90
St. Paul	3.50	4.46	5.257[4]	3.86	5.162[17]	3.813[3]	3.813[3]	3.763[3]	3.461	6.94	6.99	7.361	8.461
Omaha	3.865	5.443	5.608[4]	4.215	....	4.165	4.165	4.115	4.543	....	....	....	....
Indianapolis	3.518	4.568	4.918	3.788	4.741	3.63	3.63	3.58	4.08	5.93	6.98	6.98	8.23
Birmingham	3.45	....	4.75	3.70	....	3.55	3.55	3.50	4.53	....	....	....	....
Memphis	3.965[7]	4.66	5.265	4.215	....	4.065	4.065	4.015	4.33	....	....	....	....
New Orleans	4.058*	5.079	5.358	4.308	....	4.158	4.158*	4.108*	4.729	....	....	....	....
Houston	3.763	5.573	6.313[1]	4.313	....	4.25	4.25	3.75	6.473[3]	7.223	8.323	8.323	9.373
Los Angeles	5.00	7.20[3]	6.10[4]	4.95	5.613[15]	4.95	4.65	4.40	5.683	8.204	9.404	9.304	10.454
San Francisco	4.55[14]	7.30[4]	6.35[4]	4.50[14]	7.333[17]	4.65[14]	4.35[14]	4.15[14]	5.433	8.304	9.404	9.404	10.454
Seattle	4.65[12]	7.05[4]	5.95[4]	4.25[12]	....	4.75[12]	4.45[12]	4.35[12]	5.883	....	9.404	....	....
Portland	4.65[11]	6.60[4]	5.75[4]	4.75[11]	....	4.85[11]	4.45[11]	4.45[11]	5.633	8.304	9.404	8.304	9.404
Salt Lake City	4.53[017]	....	6.17[13]	5.53[17]	....	4.98[17]	4.98[17]	4.88[17]	6.00	....	....	....	....

National Emergency Steels

MILL EXTRAS

Designation	Basic Open-Hearth		Electric Furnace		Designation	Basic Open-Hearth		Electric Furnace	
	Bars and Bar-Strip	Billets, Blooms, and Slabs	Bars and Bar-Strip	Billets, Blooms, and Slabs		Bars and Bar-Strip	Billets, Blooms, and Slabs	Bars and Bar-Strip	Billets, Blooms, and Slabs
NE 8612	0.65¢	$13.00	$1.15	$23.00	NE 9427	0.75¢	$15.00	$1.25	$25.00
NE 8615	0.65	13.00	1.15	23.00	NE 9430	0.75	15.00	1.25	25.00
NE 8617	0.65	13.00	1.15	23.00	NE 9432	0.75	15.00	1.25	25.00
NE 8620	0.65	13.00	1.15	23.00	NE 9435	0.75	15.00	1.25	25.00
NE 8622	0.65	13.00	1.15	23.00	NE 9437	0.75	15.00	1.25	25.00
NE 8625	0.65	13.00	1.15	23.00	NE 9440	0.75	15.00	1.25	25.00
NE 8627	0.65	13.00	1.15	23.00	NE 9442	0.80	16.00	1.30	26.00
NE 8630	0.65	13.00	1.15	23.00	NE 9445	0.80	16.00	1.30	26.00
NE 8632	0.65	13.00	1.15	23.00	NE 9447	0.80	16.00	1.30	26.00
NE 8635	0.65	13.00	1.15	23.00	NE 9450	0.80	16.00	1.30	26.00
NE 8637	0.65	13.00	1.15	23.00					
NE 8640	0.65	13.00	1.15	23.00					
NE 8642	0.65	13.00	1.15	23.00	NE 9722	0.65	13.00	1.15	23.00
NE 8645	0.65	13.00	1.15	23.00	NE 9727	0.65	13.00	1.15	23.00
NE 8647	0.65	13.00	1.15	23.00	NE 9732	0.65	13.00	1.15	23.00
NE 8650	0.65	13.00	1.15	23.00	NE 9737	0.65	13.00	1.15	23.00
					NE 9742	0.65	13.00	1.15	23.00
					NE 9745	0.65	13.00	1.15	23.00
NE 8712	0.70	14.00	1.20	24.00	NE 9747	0.65	13.00	1.15	23.00
NE 8715	0.70	14.00	1.20	24.00	NE 9750	0.65	13.00	1.15	23.00
NE 8717	0.70	14.00	1.20	24.00	NE 9763	0.65	13.00	1.15	23.00
NE 8720	0.70	14.00	1.20	24.00	NE 9768	0.65	13.00	1.15	23.00
NE 8722	0.70	14.00	1.20	24.00					
NE 8725	0.70	14.00	1.20	24.00					
NE 8727	0.70	14.00	1.20	24.00	NE 9830	1.30	28.00	1.80	36.00
NE 8730	0.70	14.00	1.20	24.00	NE 9832	1.30	28.00	1.80	36.00
NE 8732	0.70	14.00	1.20	24.00	NE 9836	1.30	28.00	1.80	36.00
NE 8735	0.70	14.00	1.20	24.00	NE 9837	1.30	28.00	1.80	36.00
NE 8737	0.70	14.00	1.20	24.00	NE 9840	1.30	28.00	1.80	36.00
NE 8740	0.70	14.00	1.20	24.00	NE 9842	1.30	28.00	1.80	36.00
NE 8742	0.70	14.00	1.20	24.00	NE 9845	1.30	28.00	1.80	36.00
NE 8745	0.70	14.00	1.20	24.00	NE 9847	1.30	28.00	1.80	36.00
NE 8747	0.70	14.00	1.20	24.00	NE 9850	1.30	28.00	1.80	36.00
NE 8750	0.70	14.00	1.20	24.00					
					NE 9912	1.20	24.00	1.55	31.00
NE 9415	0.75	15.00	1.25	25.00	NE 9915	1.20	24.00	1.55	31.00
NE 9417	0.75	15.00	1.25	25.00	NE 9917	1.20	24.00	1.55	31.00
NE 9420	0.75	15.00	1.25	25.00	NE 9920	1.20	24.00	1.55	31.00
NE 9422	0.75	15.00	1.25	25.00	NE 9922	1.20	24.00	1.55	31.00
NE 9425	0.75	15.00	1.25	25.00	NE 9925	1.20	24.00	1.55	31.00

Note 1: The ranges shown are restricted to sizes 100 sq. in. or less or equivalent cross-sectional area 12 in. wide or under with a maximum individual piece weight of 7000 lb. irrespective of size. **Note 2:** For steels ordered to such ranges, below the size and weight restriction, the average of all the chemical checks must be within the limits specified subject to check analysis variations given in Table 4, Section 10, AISI Steel Products Manual. **Note 3:** When acid open-hearth is specified and acceptable, add to basic open-hearth alloy differential 0.25c. per lb. for bars and bar strip and $5 per gross ton for billets, blooms and slabs. **Note 4:** The extras shown are in addition to the base price of $2.70 for 100 lb. on finished products and $54 per gross ton on semi-finished steel, major basing points, and are in cents per pound when applicable to bars and bar-strip and in dollars per gross ton when applicable to billets, blooms and slabs. The full extra applicable over the base price is the total of all extras indicated by the specific requirements of the order. The higher extra shall be charged for any size falling between two published extras.

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD ROLLED: Sheets, 400 to 1499 lb.; strip, extras on all quantities; bars, 1500 lb. base.

NE ALLOY BARS: 1000 to 39,999 lb.

EXCEPTIONS: (1) 150 to 499 lb. (2) 150 to 1499 lb. (3) 400 to 1499 lb. (4) 450 to 1499 lb. (5) 500 to 1499 lb. (6) 0 to 199 lb. (7) 400 to 1499 lb. (8) 1000 to 1999 lb. (9) 450 to 3749 lb. (10) 400 to 3999 lb. (11) 300 to 4999 lb. (12) 300 to 10,000 lb. (13) 400 to 14,999 lb. (14) 400 lb. and over. (15) 1000 lb. and over. (16) 1500 lb. and over. (17) 2000 lb. and over. (18) 3500 lb. and over.

(*) Philadelphia: Galvanized sheet, 25 or more bundles.

Extra for size, quality, etc., apply on above quotations.

*Add 0.271c. for sizes not rolled in Birmingham.

**City of Philadelphia only. Applicable freight rates must be added to basing point prices to obtain delivered price to other localities in metropolitan area.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF, Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

Fast Tough

Heavy feed at high speed!

Heavy feed at high speed spells doom to the ordinary hack saw blade; down-time for your machine, extra expense in money, man hours, and production. The MARVEL Hack Saw Blade, because it is positively *unbreakable* under these conditions, should be a "must" tool in every efficiently operated shop. A tough alloy steel back is electrically welded to high speed steel teeth, producing a blade that can be pulled to almost unlimited tension; can withstand extra heavy feeds and the heat and abrasion of high speed heavy duty sawing.

The same exclusive *unbreakable* feature of MARVEL Hack Saw Blades is also a feature of MARVEL Hole Saws, giving these saws the ability to stand up under abuse. MARVEL Hole Saws cut holes from ⅝" to 4½" diameter in stock up to 1⅛" thick. Usable in portable drill, drill press, or lathe tail stock.

Complete Range of Metal Sawing Machines

Being the largest exclusive manufacturer of metal sawing machines and blades, both hack saw and band saw type, we have the correct answer to your cut-off problems. Each MARVEL model has a distinct application, so write us and we will send our catalog, price, and recommendation for the saw to fill your requirements most efficiently. MARVEL sawing engineers are also available to discuss and analyze your cut-off work. (Without obligation of course)

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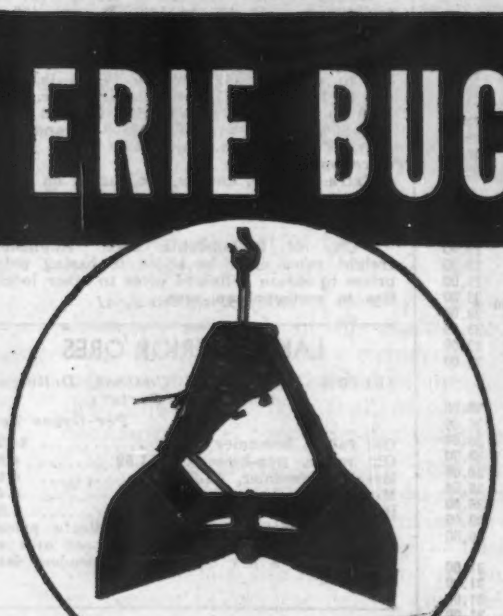
ERIE BUCKETS



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Barge Type
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Above types built in weights and capacities to suit your crane and job requirements.

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ERIE, PENNSYLVANIA

Aggre Meters • Buckets • Concrete Plants • Traveling Cranes

PRICES

WELDED PIPE AND TUBING

Base discounts, f.o.b. Pittsburgh district and Lorain, Ohio, mills

(F.o.b. Pittsburgh only on wrought pipe) base price—$200.00 per net ton

	Black	Galv.
Steel (buttweld)		
⅛-in.	63½	51
¼-in.	66½	55
⅜-in. to 3-in.	68½	57½
Wrought Iron (buttweld)		
½-in.	24	3½
¾-in.	30	10
1-in. and 1¼-in.	34	16
1½-in.	38	18½
2-in.	37½	18
Steel (lapweld)		
2-in.	61	49½
2½-in. and 3-in.	64	52½
3½-in. to 6-in.	66	54½
Wrought Iron (lapweld)		
2-in.	30½	12
2½-in. to 3½-in.	31½	14½
4-in.	33½	18
4½-in. to 8-in.	32½	17
Steel (butt, extra strong, plain ends)		
⅛-in.	61½	50½
¼-in.	65½	54½
⅜-in. to 3-in.	67	57
Wrought Iron (same as above)		
⅛-in.	35	6
¼-in.	31	12
⅜-in. to 2-in.	38	19½
Steel (lap, extra strong, plain ends)		
2-in.	59	48½
2½-in. and 3-in.	63	52½
3½-in. to 6-in.	66½	56
Wrought Iron (same as above)		
2-in.	33½	15½
2½-in. to 4-in.	39	22½
4½-in. to 6-in.	37½	21

On buttweld and lapweld steel pipe jobbers are granted a discount of 5 pct. On l.c.l. shipments prices are determined by adding 25 pct and 30 pct and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lapweld and one point lower discount, or $2 a ton higher on all buttweld.

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger are $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect 3 pct tax on freight rates.

BOILER TUBES

Seamless steel and lapweld commercial boiler tubes and locomotive tubes, Minimum wall. Net base prices per 100 ft f.o.b. Pittsburgh, in carload lots.

	Seamless Cold-Drawn	*Seamless Hot-Rolled*	*Lapweld, Hot-Rolled*
2 in. O.D. 13 B.W.G.	15.03	13.04	12.38
2½ in. O.D. 12 B.W.G.	20.21	17.54	16.58
3 in. O.D. 12 B.W.G.	22.48	19.50	18.35
3½ in. O.D. 11 B.W.G.	28.37	24.62	23.15
4 in. O.D. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb or ft and over	Base
30,000 lb or ft to 39,999 lb or ft	5 pct
20,000 lb or ft to 29,999 lb or ft	10 pct
10,000 lb or ft to 19,999 lb or ft	20 pct
5,000 lb or ft to 9,999 lb or ft	30 pct
2,000 lb or ft or 4,999 lb or ft	45 pct
Under 2,000 lb or ft	65 pct

PRICES

CORROSION AND HEAT-RESISTING STEEL

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick

	Per 1000
Super-duty brick, St. Louis	$68.55
First quality, Pa., Md., Ky., Mo., Ill.	54.45
First quality, New Jersey	59.45
Sec. quality, Pa., Md. Ky., Mo., Ill.	49.40
Sec. quality, New Jersey	54.15
No. 1 Ohio	45.75
Ground fire clay, net ton	8.05

Silica Brick

Pennsylvania and Birmingham	$54.45
Chicago District	62.48
Silica cement, net ton (Eastern)	9.55

Chrome Brick

	Per Net Ton
Standard chemically bonded, Balt., Plymouth Meeting, Chester	$54.00

Magnesite Brick

Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00

Grain Magnesite

Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$43.45
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

EXCEPTIONS TO RPS 6

Ingots, carbon, rerolling—Phoenix Iron Co. may charge $38.75; Kaiser Co., $43.00 f.o.b. Pacific Coast ports; Empire Sheet & Tinplate Co., $34.25; Pgh. Steel Co., $33.10. Granite City Steel, $39.45.

Ingots, carbon, forging—Phoenix Iron Co. may charge $43.00; Empire Sheet & Tinplate Co., $39.25, f.o.b. Mansfield, Ohio; West Coast producers, $48.00, f.o.b Pacific Coast Ports; Pgh. Steel Co., $38.10.

Ingots, alloy—C/1 delivered Detroit add $2.00; delivered East Michigan add $3.00. Connors Steel Co. may charge $45.00 f.o.b. Birmingham.

Slabs, per gross ton—Andrews Steel Co. $41 basing pts.; Wheeling Steel Corp. (rerolling) 4 in. sq. or larger $37.75 f.o.b. Portsmouth, Ohio; Empire Sheet & Tin Plate Corp. $41; Phoenix Iron Co. (rerolling) $41, (forging) $47; Granite City Steel $47.50; Kaiser Co., (rerolling) $58.64, (forging) $64.64, f.o.b. Los Angeles.

Blooms, per gross ton—Phoenix Iron Co. (rerolling) $41; (forging) $47; Pgh. Steel Co. (rerolling) $38.25, (forging) $44.25; Wheeling Steel Corp. (rerolling) 4 in. sq. or larger $37.75 f.o.b. Portsmouth; Kaiser Co. (rerolling) $58.64, (forging) $64.64 (shell steel) $74.64 f.o.b. Los Angeles.

Sheet Bar, per gross ton—Empire Sheet & Tinplate Co. $39 mill; Wheeling Steel Corp. $38 Portsmouth, Ohio.

Billets, Forging, per gross ton—Andrews Steel Co. $50 basing pts.; Follansbee Steel Corp. $49.50 Toronto, Ohio; Phoenix Iron Co. $47 mill; Geneva Steel Co. $64.64 f.o.b. Pacific Coast; Pittsburgh Steel Co. $49.50; Kaiser Co. $64.64 (shell steel) $74.64, f.o.b. Los Angeles.

A.I.S.I. HY-TEN S.A.E. N.E.

ALLOY STEELS FOR VICTORY

Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

WHEELOCK, LOVEJOY & CO., INC.

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MODERN Production Welding is done on C-F Positioners—without crane assistance, without sling crews, without extra floor space for "flopping" the weldment around so that all sides can be welded "down hand." On a C-F Positioner, the welder himself tilts and turns the weldment to position with a push button control—can tilt it up to 135° beyond horizontal, turn it to any angle or rotate it at any speed from 0 r.p.m. up.

C-F Positioners come in capacities for all weldments—from small hand operated positioners to giant units that easily handle great weldments weighing up to 30,000 lb. (1 No. 140, C-F Positioner, Capacity 14,000 lb. and 2 No. 60, 6000 lb. capacity illustrated).

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Write for Bulletin 26000 describing the Torpedo Hoist shown. Three capacities 250 lb. — $139.50, 500 lb. — $149.50, 1000 lb.—$159.50. Heavily, simply built, with Push Button Control. Outstanding in CONCO'S complete line of hand-powered and electric Cranes, Hoists, Trolleys.

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Versatility SPEEDS HANDLING — LOWERS COSTS

KRANE KAR lifts, transports, and positions the load. No need to maneuver the vehicle—swing the 'live' boom from side to side and up or down, by power, with full load on hook. KRANE KAR hauls trailers, spots cars, loads and unloads freight and cargo; moves, piles, and stacks loads of all shapes and sizes safely and efficiently. Ideal for maintenance and repair operations. KRANE KAR versatility speeds production output, lowers handling costs. Write for Catalog No. 58.

USERS: Basic Magnesium; Monsanto Chem. Co.; Pullman Co.; Standard Oil; General Motors; Chrysler Corp.; General Electric; Otis Elevator Co.; Boeing Aircraft; E.I. DuPont de Nemours; etc.

Agents in the Principal Cities

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

2½, 5, AND 10 TON CAPACITIES

KRANE KAR

TRADE MARK REGISTERED

SILENT HOIST & CRANE CO., 851 63rd ST., BKLYN 20, N.Y.

PRICES

Billets, Rerolling, per gross ton—Continental Steel Corp. may charge Acme Steel in Chicago switching area $34 plus freight from Kokomo, Ind.; Northwestern Steel & Wire Co. (Lend-Lease) $41 mill; Wheeling Steel Corp. 4 in. sq. or larger $37.75, smaller $39.50 f.o.b. Portsmouth, Ohio; Stanley Works may sell Washburn Wire Co. under allocation at $39 Bridgeport, Conn.; Keystone Steel & Wire Co. may sell Acme Steel Co. at $39 base, f.o.b. Peoria; Phoenix Iron Co. $41 mill; Continental Steel Corp. (1¾ x 1¾) $39.50, (2 x 2) $40.60 Kokomo, Ind. (these prices include $1 size extra); Keystone Steel & Wire Co. $36.40 Peoria; Connors Steel Co. $50.60 Birmingham; Ford Motor Co. $34 Dearborn, Mich.; Geneva Steel Co. $58.64 f.o.b. Pacific Coast; Pgh. Steel Co. $43.50; Kaiser Co $58.64 f.o.b. Los Angeles.

Structural Shapes—Phoenix Iron Co. 2.35c basing pts. (export) 2.50c. Phoenixville; Knoxville Iron Co. 2.30c. basing points; Kaiser Co. 3.20c. f.o.b. Los Angeles.

Rails, per gross ton—Sweet Steel Co. (rail steel) $50 mill; West Virginia Rail Co. (lightweight) on allocation based Huntington, W. Va.; Colorado Fuel & Iron, $45 Pueblo.

Hot Rolled Plate—Granite City Steel Co. 2.85c. produced on DPC eqpt., 2.35c. otherwise; Knoxville Iron Co., 2.25c. basing pts.; Kaiser Co. and Geneva Steel Co. 3.20c. Pacific Ports; Central Iron and Steel Co. 2.50c. basing points; Granite City Steel Co. 2.35c. Granite City.

Merchant Bars—W. Ames Co., 10 tons and over, 2.85c. mill; Eckels-Nye Steel Corp. 2.50c. basing pts. (rail steel) 2.40c.; Phoenix Iron Co. 2.40c. basing pts.; Sweet Steel Co. (rail steel) 2.33c. mill; Joslyn Mfg. & Supply Co., 2.35c. Chicago; Calumet Steel Div., Borg Warner Corp. (8 in. mill bar), 2.35c. Chicago; Knoxville Iron Co., 2.30c. basing pts.; Laclede Steel Co., sales to LaSalle Steel granted Chicago base, f.ob Madison, Ill.; Milton Mfg. Co., 2.75c. f.o.b. Milton, Pa.

Pipe Skelp—Wheeling Steel, Benwood, 2.05c.

Reinforcing Bars—W. Ames & Co., 10 tons and over, 2.85c. mill; Sweet Steel Co. (rail steel), 2.33c. mill; Columbia Steel Co., 2.50c. Pacific Ports.

Cold Finished Bars—Keystone Drawn Steel Co. on allocation, Pittsburgh c.f. base plus c/l freight on hot rolled bars Pittsburgh to Spring City, Pa.; New England Drawn Steel Co. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to Mansfield, Mass., f.o.b. Mansfield; Empire Finished Steel Corp. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to plants, f.o.b. plant; Compressed Steel Shafting Co. on allocation outside New England, Buffalo base plus c/l freight Buffalo to Readville, Mass., f.o.b. Readville; Medart Co. in certain areas, Chicago c.f. base plus c/l freight Chicago to St. Louis, f.o.b. St. Louis.

Alloy Bars—Texas Steel Co., for delivery except Texas and Okla., Chicago base, f.o.b. Fort Worth, Tex.; Connors Steel Co., shipped outside Ala., Mississippi, Louisiana, Georgia, Florida, Tenn., Pittsburgh base, f.o.b. Birmingham.

Hot Rolled Strip—Joslyn Mfg. & Supply Co., 2.30c. Chicago; Knoxville Iron Co., 2.25c. basing pts.

Hot Rolled Sheets—Andrews Steel Co., Middletown base on shipments to Detroit or area; Parkersburg Iron & Steel, 2.25c. Parkersburg. Granite City Steel 2.45c.

Galvanized Sheets—Andrews Steel Co. 3.75c. basing pts.; Parkersburg Iron & Steel Co., 3.85c. Parkersburg; Continental Steel Co., Middletown base on Kokomo, Ind., product; Superior Sheet Steel Co., Pittsburgh base except for Lend-Lease.

Pipe and Tubing—South Chester Tube Co. when priced at Pittsburgh, freight to Gulf Coast and Pacific Ports may be charged from Chester, Pa., also to points lying west of Harrisburg, Pa.

Black Sheets—Empire Sheet and Tinplate Co., maximum base price mill is 2.45c. per 100 lb., with differentials, transportation charges, etc., provided in RPS. No. 6.

Wire Products—Pittsburgh Steel Co., f.o.b. Pittsburgh, per 100 lb., rods, No. 5 to 9/32 in., 2.20c.; rods, heavier than 9/32, 2.35c.; bright wire, 2.725c.; bright nails, 2.90c.; lead and furnace annealed wire, 2.85c.; pot annealed wire, 2.85c.; galvanized barbed wire, 3.90c.; plain staples, 2.55c.; galvanized staples, 2.65c.; bright spring wire, 3.30c.; galvanized spring wire, 3.45c.

PIG IRON PRICES

BASING POINT* BASE PRICES

Basing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	$25.50	$26.00	$26.50	$27.00	.....
Birdsboro	25.50	26.00	26.50	27.00	$30.50
Birmingham	20.00	21.38	.....	25.00	.....
Buffalo	24.00	25.00	25.50	26.00	30.50
Chicago	24.50	25.00	25.00	25.50	.....
Cleveland	24.50	25.00	25.00	25.50	.....
Detroit	24.50	25.00	25.00	25.50	.....
Duluth	25.00	25.50	25.50	26.00	.....
Erie	24.50	25.00	25.50	26.00	.....
Everett	25.50	26.00	26.50	27.00	.....
Granite City	24.50	25.00	25.00	25.50	.....
Hamilton	24.50	25.00	25.00	.....	.....
Neville Island	24.50	25.00	25.00	25.50	.....
Provo	22.50	23.00	.....	.....	.....
Sharpsville[1]	24.50	25.00	25.00	25.50	.....
Sparrows Point	25.50	26.00	.....	.....	.....
Steelton	25.50	.....	.....	.....	30.50
Swedeland	25.50	26.00	26.50	27.00	.....
Toledo	24.50	25.00	25.00	25.50	.....
Youngstown	24.50	25.00	25.00	25.50	.....

DELIVERED PRICES† (BASE GRADES)

Consuming Point	Basing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Boston	Everett	$ .50	$26.00	$26.50	$27.00	$27.50	.....
Boston	Birdsboro-Steelton	4.02	.....	.....	.....	.....	$34.52
Brooklyn	Bethlehem	2.50	28.00	28.50	29.00	29.50	.....
Brooklyn	Birdsboro	2.92	.....	.....	.....	.....	33.42
Canton	Cleveland	1.39	25.89	26.39	26.89	28.89	.....
Canton	Buffalo	3.19	.....	.....	.....	.....	33.69
Cincinnati	Birmingham	4.06	24.06	25.44	.....	.....	.....
Cincinnati	Hamilton	1.11	.....	.....	26.11	.....	.....
Cincinnati	Buffalo	4.40	.....	.....	.....	.....	34.90
Jersey City	Bethlehem	1.53	27.03	27.53	28.03	28.53	.....
Jersey City	Birdsboro	1.94	.....	.....	.....	.....	32.44
Los Angeles	Provo	4.96	27.46	27.96	.....	.....	.....
Los Angeles	Buffalo	15.41	.....	.....	.....	.....	46.91
Mansfield	Cleveland & Toledo	1.94	26.44	26.94	26.94	27.44	.....
Mansfield	Buffalo	3.36	.....	.....	.....	.....	33.86
Philadelphia	Swedeland	.84	26.34	26.84	27.34	27.84	.....
Philadelphia	Birdsboro	9.24	.....	.....	.....	.....	31.74
San Francisco	Provo	4.96	27.46	27.96	.....	.....	.....
San Francisco	Buffalo	15.41	.....	.....	.....	.....	46.91
Seattle	Provo	4.96	27.46	27.96	.....	.....	.....
Seattle	Buffalo	15.41	.....	.....	.....	.....	46.91
St. Louis	Granite City	.50	25.00	25.50	26.00	26.00	.....
St. Louis	Buffalo	7.07	.....	.....	.....	.....	37.57

* Maximum per gross ton, established by OPA February 14, 1945. † Prices do not reflect 3 per cent tax on freight.

(1) Struthers Iron & Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Charcoal pig iron base prices for Lyles, Tenn., and Lake Superior furnaces, $35.00 and $34.00, respectively. Newberry Brand of Lake Superior charcoal iron $39.00 per g.t., f.o.b. furnace, by order L 39 to RPS 10, April 11, 1945, retroactive to March 7, 1945. Delivered to Chicago, $42.34. High phosphorus iron sells at Lyles, Tenn., at $28.50.

Basing point prices are subject to switching charges; Silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 to 2.25 per cent); Phosphorus differentials, a reduction of 38c. per ton for phosphorus content of 0.70 per cent and over; Manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

Silvery iron and bessemer ferrosilicon up to and including 14.00 per cent silicon covered by RPS 10 as amended Feb. 14, 1945. Silvery iron, silicon 6.00 to 6.50 per cent, C/L per G.T., f.o.b. Jackon, Ohio—$30.50; f.o.b. Buffalo—$31.75. Add $1.00 per ton for each additional 0.50% Si. Add 50c. per ton for each 0.50% Mn over 1.00%. Add $1.00 per ton for 0.75% or more P. Bessemer ferrosilicon prices are $1.00 per ton above silvery iron prices of comparable analysis.

METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. F.o.b. shipping point, ¢ per lb, ton lots.

Copper, electrolytic, 150 and 200 mesh	21½¢ to 23½¢
Copper, reduced, 150 and 200 mesh	20½¢ to 25½¢
Iron, commercial, 100 and 200 mesh 96 + % Fe	12½¢ to 15¢
Iron, crushed, 200 mesh and finer, 90 + % Fe carload lots	4¢
Iron, hydrogen reduced, 300 mesh and finer, 98½ + % Fe, drum lots	63¢
Iron, electrolytic, unannealed, 300 mesh and coarser, 99 + % Fe	30 to 33¢
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe	42¢
Iron carbonyl, 300 mesh and finer, 98-99.8 + % Fe	90¢
Aluminum, 100 and 200 mesh	*25¢
Antimony, 100 mesh	30¢
Cadmium, 100 mesh	$1.40
Chromium, 100 mesh and finer	$1.25
Lead, 100, 200 & 300 mesh	11½ to 15¢
Manganese	65¢
Nickel, 150 mesh	51½¢
Solder powder, 100 mesh	8½¢ plus metal
Tin, 100 mesh	58¾¢
Tungsten metal powder, 98%-99%, any quantity, per lb	$2.60
Molybdenum powder, 99%, in 200-lb kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb	$3.00

*Freight allowed east of Mississippi.

COKE

	Net Ton
Furnace, beehive (f.o.b. oven)	
Connellsville, Pa.	$7.50*
Foundry, beehive (f.o.b. oven)	
Fayette Co., W. Va.	8.10
Connellsville, Pa.	9.00
Foundry, By-Product	
Chicago, del'd	13.75
Chicago, f.o.b.	13.00
New England, del'd	14.65
Kearny, N. J., f.o.b.	13.05
Philadelphia, del'd	13.28
Buffalo, del'd	13.40
Portsmouth, Ohio, f.o.b.	11.50
Painesville, Ohio, f.o.b.	12.15
Erie, del'd	13.15
Cleveland, del'd	13.20
Cincinnati, del'd	13.35
St. Louis, del'd	14.25
Birmingham, del'd	10.90

* Hand drawn ovens using trucked coal permitted to charge $8.60 per ton plus transportation charges.

WRITE FOR BULLETINS 22-23-B-11 and 21-B-35

If you want to put your air supply on the most economical and reliable basis possible, specify Roots-Connersville Rotary Positive Blowers. Their reputation for continued performance under peak loads (at moderate pressures) has been well established by countless service records.

"R-C" Blowers do not use liquid seals or lubrication in the impeller chamber; therefore, the air discharged is as clean as when it enters.

ROOTS-CONNERSVILLE BLOWER CORP.

One of the Dresser Industries

509 Ohio Avenue Connersville, Indiana

Roots CONNERSVILLE SINCE 1854 Rotary Positive BLOWERS

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WILL FIND IT!

The new FLASH-O-LENS offers foundry-men, machinists, and many others engaged in producing metal parts an efficient, economical means of examining the most minute defects during routine inspections.

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SOLID STEEL—*all grades*
LAID STEEL—*hi-speed and carbon*
ROTARY SHEARS *and* SLITTERS

The OHIO KNIFE *Co.*
CINCINNATI 22, OHIO

PRICES

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

Base discount less case lots

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all lengths	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

⅛ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
Base discount less keg lots		
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 in. through 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full keg lots, 10 per cent additional discount.

Stove Bolts — *Consumer*

Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets

(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws	*Consumer Per Cent Off List*
Upset full fin, hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Fillister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.30c.
Armature	3.65c.
Electrical	4.15c.
Motor	5.05c.
Dynamo	5.75c.
Transformer 72	6.25c.
Transformer 65	7.25c.
Transformer 58	7.75c.
Transformer 52	8.55c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

PRICES

Ferromanganese

78-82% Mn, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Carload lots (packed)	141.00
Less ton lots (packed)	148.50

$1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Manganese Metal

Contract basis, lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Spot sales add 2c. per lb.

96-98% Mn, .2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	32c.
L.c.l. lots	34c.

Spiegeleisen

Maximum base, contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Carloads	$35.00	$36.00
Less ton	47.50	48.50

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carloads, f.o.b. shipping point with freight allowed.

	Eastern Zone	Central Zone	Western Zone
50% Si	6.65c.	7.10c.	7.25c.
75% Si	8.05c.	8.20c.	8.75c.
80-90% Si.	8.90c.	9.05c.	9.55c.
90-95% Si.	11.05c.	11.20c.	11.65c.

Spot sales add: 45c. per lb. for 50% Si, .3c. per lb. for 75% Si, .25c. per lb. for 80-90% and 90-95% Si.

Silvery Iron

Silvery Iron, Silicon 14.01 to 14.50 per cent, $45.50 per G. T. f.o.b. Jackson, Ohio. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 per ton for low impurities, not to exceed: P—0.05%, S—0.04%, C—1.00%. Covered by MPR 405.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe..	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe..	13.45c.	13.90c.	16.80c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% Si. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	3.35c.	3.50c.	3.65c.
2000 lb-carload	3.8c.	4.2c.	4.25c.

Silicomanganese

Contract basis lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Add .25c. for spot sales. 65-70% Mn, 17-20% Si, 1.5% max. C.

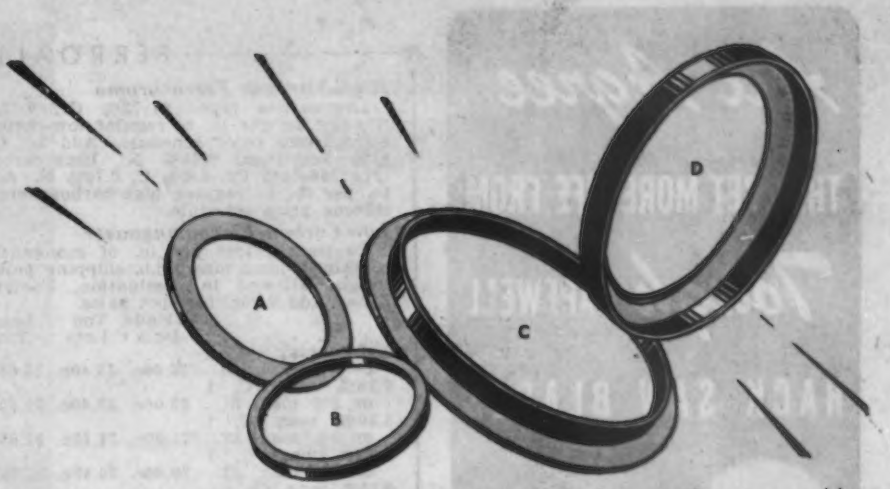
Carload, bulk	6.05c.
2000 lb. to carload	6.70c.
Under 2000 lb.	6.90c.
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.80c.
2000 lb. to carload	6.30c.
Less ton lots	6.55c.

Ferrochrome

(65-72% *Cr. 2% max. Si*)

OPA maximum base contract prices per lb. of contained Cr, lump size in carload lots, f.o.b. shipping point, freight allowed to destination. Add .25c. per lb. contained Cr for spot sales.

	Eastern Zone	Central Zone	Western Zone
0.06% C	23.00c.	23.40c.	24.00c.
0.10% C	22.50c.	22.90c.	23.50c.
0.15% C	22.00c.	22.40c.	23.00c.
0.20% C	21.50c.	21.90c.	22.50c.
0.50% C	21.00c.	21.40c.	22.00c.
1.00% C	20.50c.	20.90c.	21.50c.
2.00% C	19.50c.	19.90c.	21.00c.
66-71% Cr, 4-10%	13.00c.	13.40c.	14.00c.
62-66% Cr, 5-7% C	13.50c.	13.90c.	14.50c.



For nearly forty years—through peace and war times—King has supplied metal rings and flanges to industry. And throughout that period, the name "King" has been synonymous with highest quality materials, craftsmanship, dependability. Rolled hot or cold from bar stock steel or non-ferrous metals, King Rings and Flanges are true to size, perfectly welded, smooth-finished.

Variety and versatility are seldom found in the equipment of a maker of rings and flanges. But these attributes characterize the King organization. Unusual dimensions, peculiar shapes, the ability to work with company engineers along unprecedented lines—these are qualities you will find at King.

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B Band Ring
C Leg-out Angle Ring
D Leg-in Angle Ring

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"HERCULES" RED-STRAND WIRE ROPE

You Can Depend On "Hercules" (Red Strand) Wire Rope

Highlights of Quality

1. Acid Open-Hearth Steel Wire
2. Rigid Tests and Inspections
3. Correct Manufacturing Methods
4. Furnished in both the Round and Flattened Strand constructions, in either Standard or Preformed Type.

• • Results are what count, and the performance record of this wire rope continues to make and hold friends.

There is no guess work when you use "HERCULES" (Red-Strand) Wire Rope. It is designed and built to do specific jobs better . . . safer . . . more economically. If you will tell us how you use wire rope, we shall be glad to suggest the construction and type most suitable for your conditions.

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All Agree

THEY GET MORE LIFE FROM

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HACK SAW BLADES

PROPELLER MANUFACTURER, cutting 4½" square billets of special chrome tungsten alloy steel, increased average blade life up to 25%.

MOTOR CAR MANUFACTURER had a bottleneck cutting cast iron pistons with 1/16" stainless steel coverings. Capewell's *Technite* removed the jam, speeded war production.

BREWERY, cutting No. 304 Stainless Steel Pipe ranging up to 6" diameter with 5/16" walls, had believed the job too tough for hack saw blades, yet Capewell's *Technite* made a record of 28 hours continuous sawing.

CAPEWELL

HACK SAW BLADES

THE CAPEWELL MFG. CO.
Hartford, 2, Conn.

FERROALLOY PRICES

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 2c. per lb. to regular low-carbon ferrochrome price schedule. Add 2c. for each additional 0.25% N. High-carbon type: 66-71% Cr, 4-5% C, 0.75% N. Add 5c. per lb. to regular high-carbon ferrochrome price schedule.

Low-Carbon Ferromanganese

Contract prices per lb. of manganese contained, lump size, f.o.b. shipping point, freight allowed to destination, Eastern Zone. Add 0.25c. for spot sales.

	Carloads, Bulk	Ton Lots	Less Ton
0.10% max. C, 1 or 2% max. Si..	23.00c.	23.40c.	23.65c.
0.15% max. C, 1 or 2% max. Si..	22.00c.	22.40c.	22.65c.
0.30% max. C, 1 or 2% max. Si..	21.00c.	21.40c.	21.65c.
0.50% max. C, 1 or 2% max. Si..	20.00c.	20.40c.	20.65c.
0.75% max. C, 7.00% max. Si..	16.00c.	16.40c.	16.65c.

Ferrochrome Briquets

Contract prices per lb. of briquet, f.o.b. shipping point, freight allowed to destination. Approx. 60 per cent contained chromium. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk..	8.35c.	8.55c.	8.95c.
Ton lots	8.75c.	9.25c.	10.75c.
Less ton lots..	9.00c.	9.50c.	11.00c.

Ferromanganese Briquets

Contract prices per lb. of briquet, f.o.b. shipping point, freight allowed to destination. Approx. 66 per cent contained manganese. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk..	6.05c.	6.30c.	6.60c.
Ton lots	6.65c.	7.55c.	8.55c.
Less ton lots..	6.80c.	7.80c.	8.80c.

Calcium—Manganese—Silicon

Contract prices per lb. of alloy, lump size, f.o.b. shipping point, freight allowed to destination.

16-20% Ca, 14-18% Mn, 53-59% Si. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carloads	15.50c.	16.00c.	18.05c.
Ton lots	16.50c.	17.35c.	19.10c.
Less ton lots.	17.90c.	17.35c.	19.60c.

Calcium Metal

Eastern zone contract prices per lb. of metal, f.o.b. shipping point, freight allowed to destination. Add 5c. for spot sales. Add 0.9c. for Central Zone; 0.49c. for Western Zone.

	Cast	Turnings	Distilled
Ton lots	$1.80	$2.30	$5.00
Less ton lots..	2.30	2.80	5.75

Chromium—Copper

Contract price per lb. of alloy, f.o.b. Niagara Falls, freight allowed east of the Mississippi River. 8-11% Cr, 88-90% Cu, 1.00% max. Fe, 0.50% max. Si. Add 2c. for spot sales.

Shot or ingot ..... 45c.

Ferroboron

Contract prices per lb. of alloy, f.o.b. shipping point, freight allowed to destination. Add 5c. for spot sales. 17.50% min. B. 1.50% max. Si, 0.50% max. Al, 0.50% max. C.

	Eastern Zone	Central Zone	Western Zone
Ton lots	$1.20	$1.2075	$1.229
Less ton lots..	1.30	1.3075	1.329

Manganese—Boron

Contract prices per lb. of alloy, f.o.b. shipping point, freight charges allowed. Add 5c. for spot sales.

75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C.

	Eastern Zone	Central Zone	Western Zone
Ton lots	$1.89	$1.902	$1.935
Less ton lots..	2.01	2.023	2.055

Nickel—Boron

Spot and contract prices per lb. of alloy, f.o.b. shipping point, freight allowed to destination.

15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni.

	Eastern Zone	Central Zone	Western Zone
11,200 lb. or more ...	$1.90	$1.9125	$1.9445
Ton lots	2.00	2.09125	2.0445
Less ton lots..	2.10	2.1125	2.1445

Other Ferroalloys

Ferrotungsten, Standard grade lump or ¼X down, packed, f.o.b. plant at Niagara Falls, New York, Washington, Pa. York, Pa., per lb. contained tungsten, 10,000 lb. or more.... $1.90

Ferrovanadium, 35-55%, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. contained Va.

Open hearth	$2.70
Crucible	$2.80
Primos	$2.90

Cobalt, 97% min., keg packed, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. of cobalt metal..... $1.50

Vanadium pentoxide, 88-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5. Spot sales add 5c. per lb. contained V_2O_5..... $1.10

Silcaz No. 3, contract basis, f.o.b. producer's plant with usual freight allowances, per lb. of alloy. (Pending OPA approval)

Carload lots	25c.
2000 lb. to carload.....	26c.

Silvaz No. 3, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy (Pending OPA approval)

Carload lots	58c.
2000 lb. to carload.....	59c.

Grainal, f.o.b. Bridgeville, Pa., freight allowed 50 lb. and over, max. based on rate to St. Louis

No. 1	87.5c.
No. 6	60c.
No. 79	45c.

Bortram, f.o.b. Niagara Falls

Ton lots, per lb.....	45c.
Less ton lots, per lb.....	50c.

Ferrocolumbium, 50-60%, contract basis, f.o.b. plant with freight allowances, per lb. contained Cb.

2000 lb. lots	$2.25
Under 2000 lb. lots.....	$2.30

Ferrotitanium, 40-45%, 0.10%C. max. f.o.b. Niagara Falls, N. Y., ton lots, per lb. contained Ti.. $1.23
Less ton lots..... $1.25

Ferrotitanium, 20-25%, 0.10%C. max., ton lots, per lb. contained titanium $1.35
Less ton lots..... $1.40

High-carbon ferrotitanium, 15%-20%, 6-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y. freight allowed East of Mississippi River, north of Baltimore and St. Louis, per carload.....$142.50

Ferrophosphorus, 18% electric or blast furnaces, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equalled with Rockdale, Tenn., per gross ton..... 58.50

Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage freight equalized with Nashville, per gross ton $75.00

Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., any quantity, per lb. contained Mo. 95c.

Calcium molybdate, 40-45%, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained Mo. ..... 80c.

Molybdenum oxide briquets, 48-52% Mo. f.ob. Langeloth, Pa. per lb. contained Mo..... 80c.

Molybdenum oxide, in cans, f.o.b Langeloth and Washington, Pa. per lb. contained Mo..... 80c.

Zirconium, 35-40%, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy. Add ¼c. for spot sales

Carload lots	14c.

Zirconium, 12-15%, contract basis, lump f.o.b. plant usual freight allowances, per lb. of alloy

Carload, bulk	4.6c.

Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, carload, bulk ..... 5.75c.
Ton lots ..... 7.25c.

Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, f.o.b. Philo, Ohio, with freight not to exceed St. Louis rate allowed, per lb.

Car lots	8.00c.
Ton lots	8.75c.
Less ton lots	9.25c.

$1.90

$2.70
$2.30
$2.90

$1.50

$1.10

25c.
26c.

58c.
59c.

87.5c.
60c.
45c.

45c.
50c.

$2.25
$2.30

$1.23
$1.25

$1.35
$1.40

$142.50

58.50

$75.00

95c.

80c.

80c.

80c.

14c.

4.6c.

5.75c.
7.25c.

8.00c.
8.75c.
9.25c.